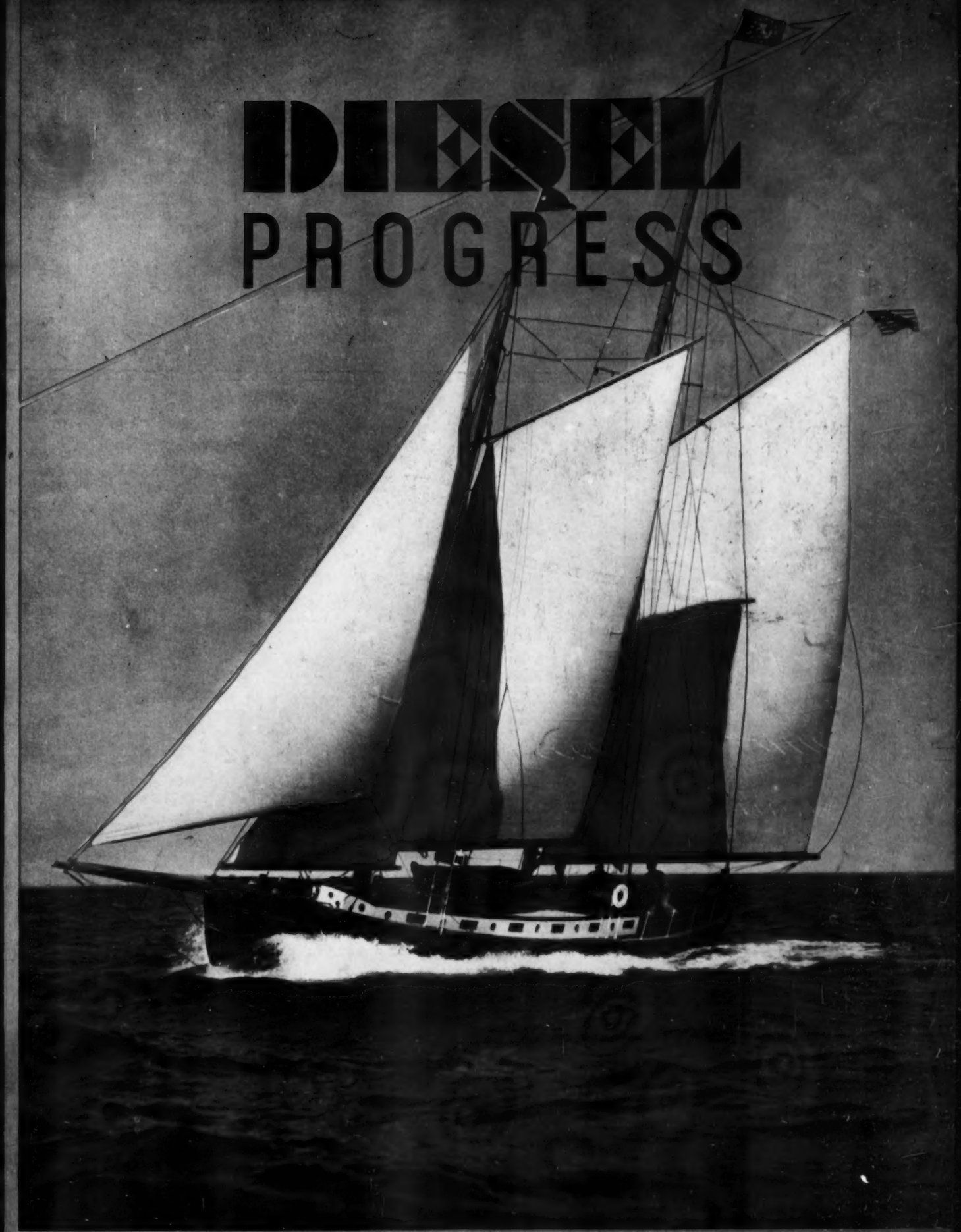
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



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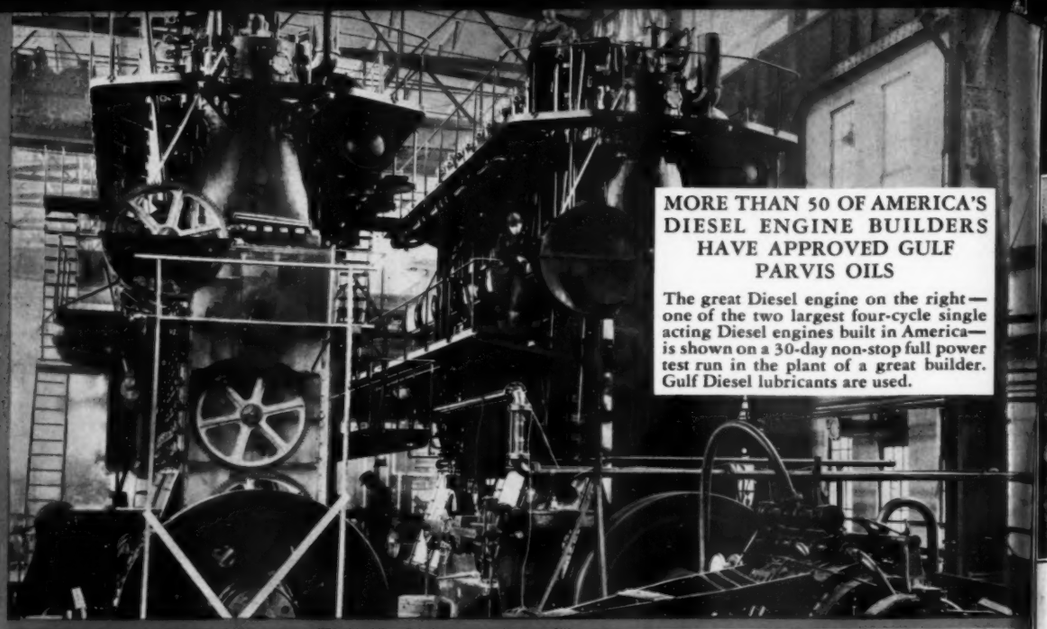
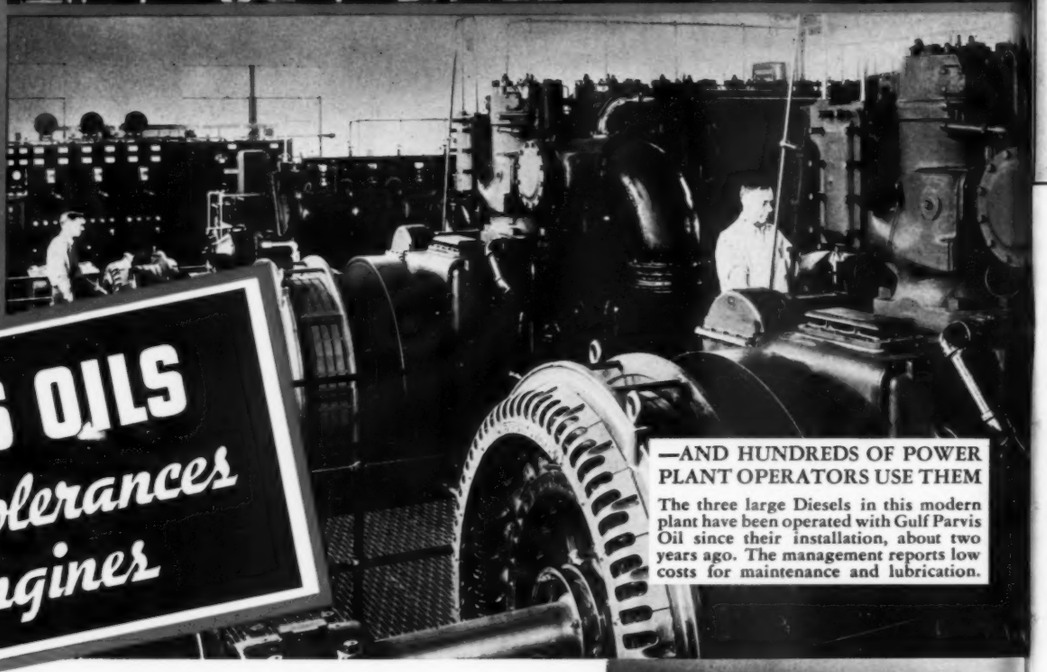
BUILDERS AND OPERATORS agree



MORE THAN 50 OF AMERICA'S DIESEL ENGINE BUILDERS HAVE APPROVED GULF PARVIS OILS

The great Diesel engine on the right—one of the two largest four-cycle single acting Diesel engines built in America—is shown on a 30-day non-stop full power test run in the plant of a great builder. Gulf Diesel lubricants are used.



—AND HUNDREDS OF POWER PLANT OPERATORS USE THEM

The three large Diesels in this modern plant have been operated with Gulf Parvis Oil since their installation, about two years ago. The management reports low costs for maintenance and lubrication.

GULF PARVIS OILS preserve close tolerances in Diesel Engines

LEADING DIESEL BUILDERS use Gulf Parvis Oil in their plants for engine run-ins and tests before shipment. That speaks volumes for the quality of this Diesel lubricant.

Today's Diesels are built with close tolerances. Moving parts are carefully calibrated to assure close fit and long life. A lubricant of highest quality is needed to minimize wear and maintain the efficiency of the unit from the start.

Gulf Parvis Oils—approved by more than 50 of America's Diesel engine builders—have demonstrated their value in scores of plants from Maine to Texas. They are the most economical Diesel lubricants you can use.

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GENERAL OFFICES: GULF BUILDING, PITTSBURGH, PENNSYLVANIA

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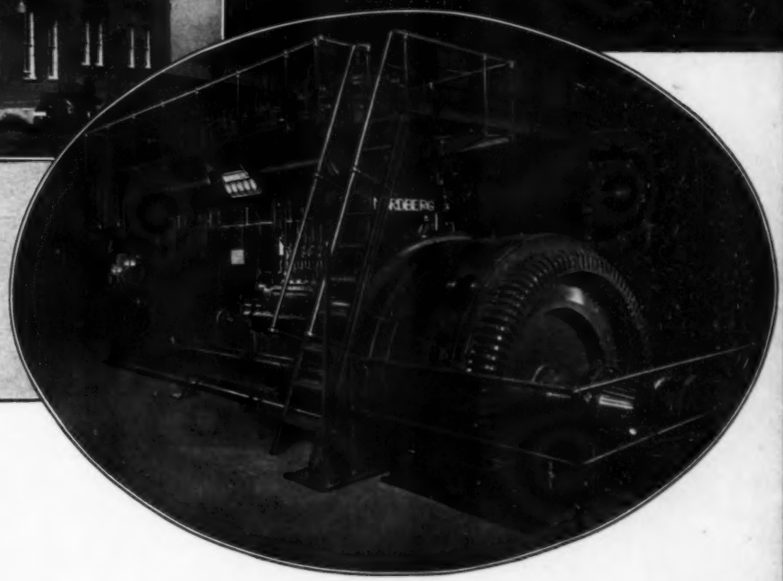
THAT GOOD GULF GASOLINE AND GULFLUBE MOTOR OIL

GULF INDUSTRIAL LUBRICATION

DIESEL PROGRESS for September, 1936. Volume II, No. 9. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Pan American countries $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U.S.A., 50 cents for all other countries.

Performance Brings Another REPEAT ORDER



A Second Unit For Sioux Falls

AS a result of the satisfactory performance of the first five-cylinder 1250 hp. Nordberg two-cycle engine in the municipal power plant at Sioux Falls, a second engine of 1500 hp., a duplicate unit in six cylinders, has now been chosen to provide increased capacity. The first engine on a 61½-day continuous run with an average load factor of 47.8 per cent generated 612,800 kwh. on 60,659 gallons of fuel oil, or 12.13 kwh. per gallon of fuel. One gallon of lubricating oil developed 3,580 hp. hours.

It is because of this kind of service that a large percentage of Nordberg owners have made their second and third purchases of Nordberg Diesels.

Low Fuel Consumption

Because Nordberg Diesels use less fuel, plants equipped with them show greater profits.

Low in Maintenance

Their better design and construction reduce the expense of repairs and upkeep.

Dependability

Built to give the utmost in dependable service under long periods of operation under heavy load.

Simplicity

All operators like Nordberg engines because of their simplicity in design and the ease with which they can be cared for.

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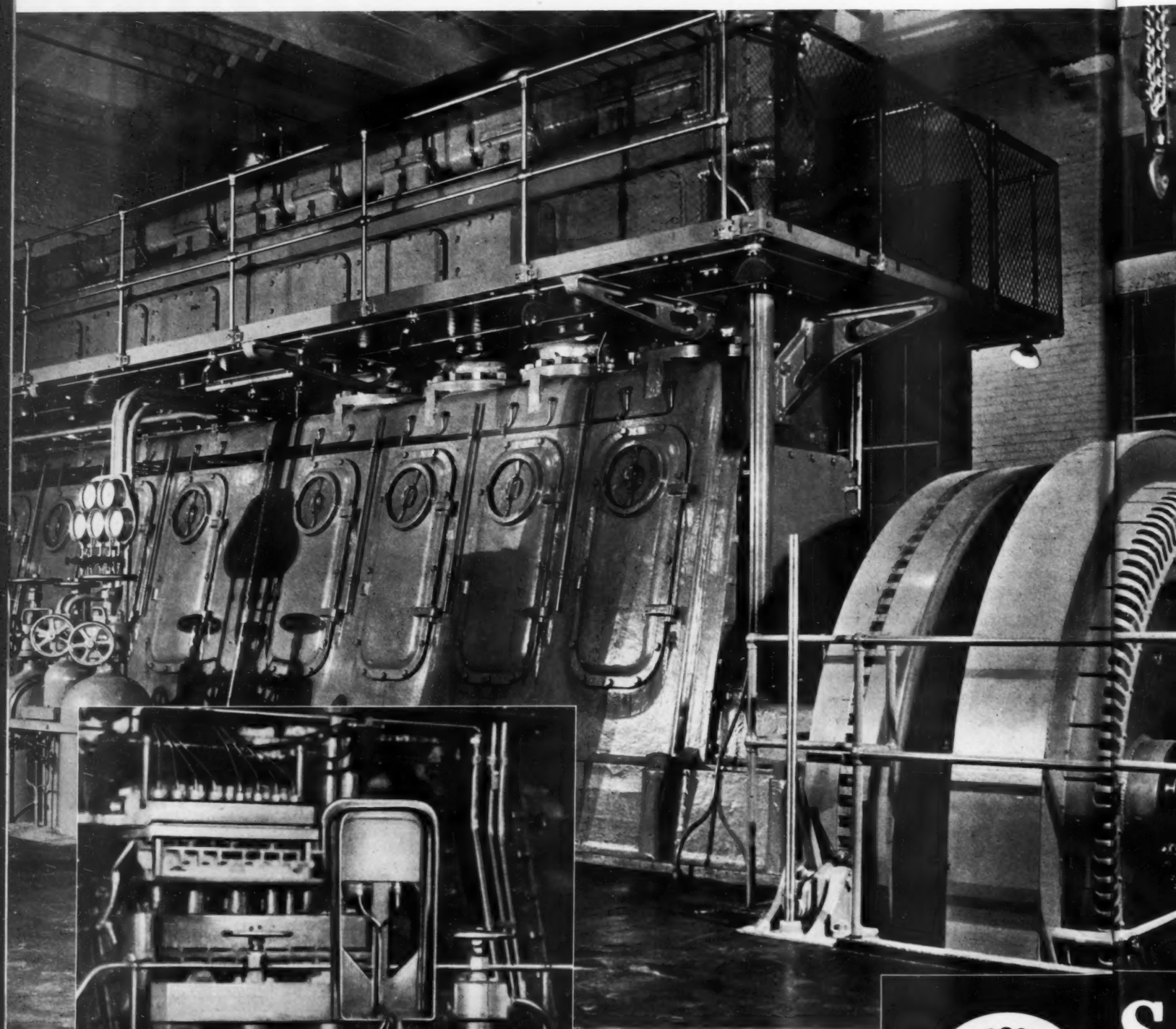

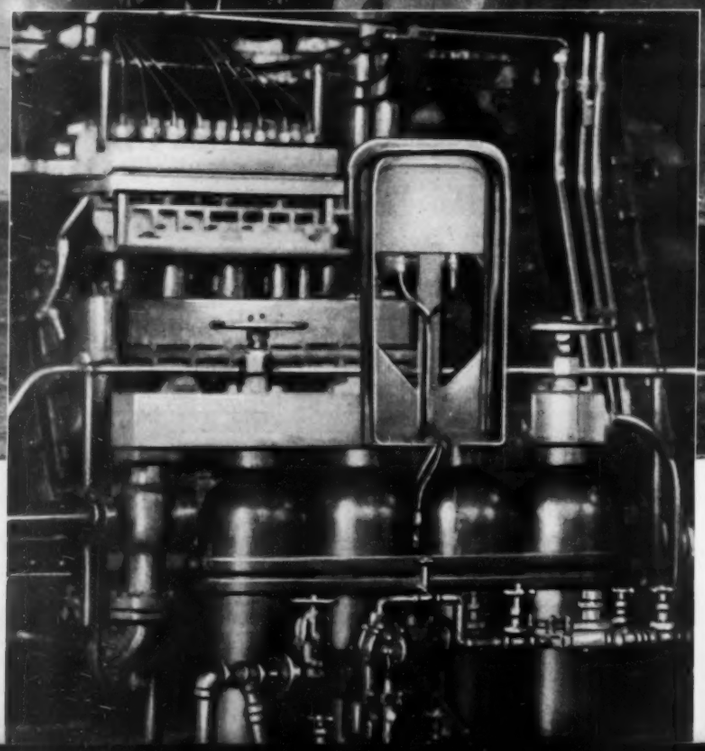

ON INSTALLATIONS like this where dependable performance is demanded year after year, Gargoyle D.T.E. Oils are helping to pay their own way by minimizing cleaning periods . . . reducing repairs.

GARGOYLE D.T.E. OILS have an enviable reputation for freedom from sludge-forming elements. Cleaning periods are often much further apart. This has helped thousands of Diesel operators lower costs and reduce fuel consumption.

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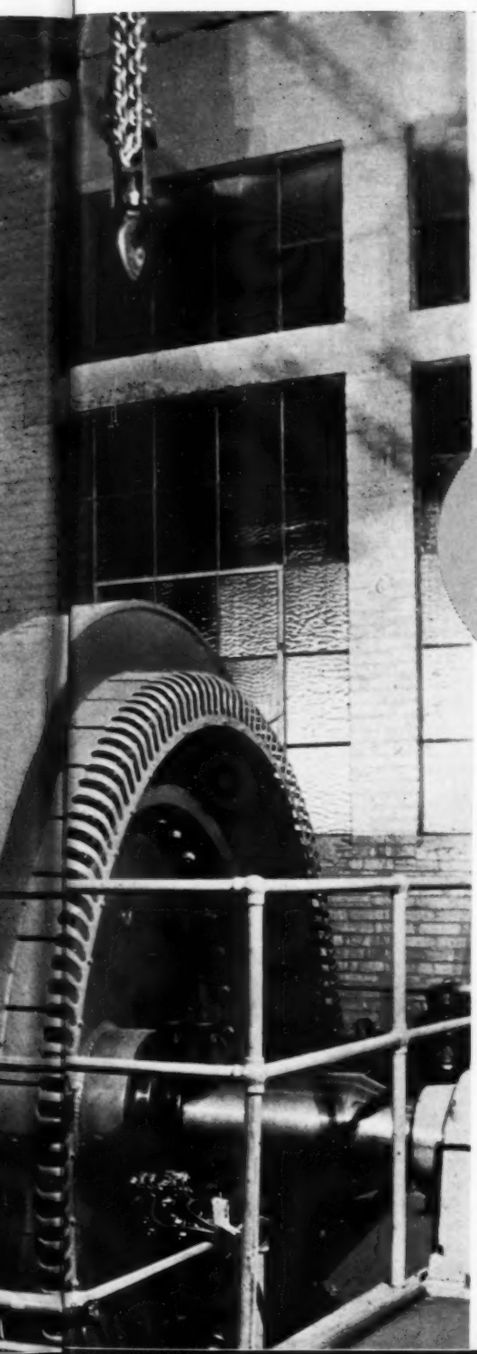
Too Much *to Pay for* Oil!



Because One Inferior Batch of Oil May Result in Ruinous Damage . . . Shrewd Diesel Operators Rely on the Uniform High Quality of Gargoyle D.T.E. Oils

"IT'S THE BEST INSURANCE in the world!" That's how one operator expressed it when he placed his order for Gargoyle D. T. E. Oils. He gave the reason why thousands of other operators . . . after comparing Diesel lubricants . . . buy Gargoyle D.T.E. Oils.

Operators like these, who demand that capital investment be completely insured, are also securing profit protection with Gargoyle D.T.E. Oils. These famous oils are made to help Diesels operate continuously at maximum economy. They hold fuel consumption and cleaning periods to a minimum.

We're prejudiced, you say? As engineers, backed by 70 years' lubricating experience, and trained to analyze problems thoroughly, we've a right to be. But you don't *need* to take our word for it. Gargoyle D.T.E. Oils are sold on proved performance.

• • •

WITHOUT A DOUBT, our files contain an example of Diesels similar to yours, that once ran on the oil you're using today . . . and later changed to Gargoyle D.T.E. Oils.

If we can prove to you that economies resulted from this change . . . that profits were earned which announced careful management right in the operating statement—would you be interested? Talk this over with the Socony-Vacuum man the next time he calls on you.

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Buda has sailed the rough course of Diesel Engine Development, overcoming the difficulties a pioneer must meet and making available for the boat owner the greatest Diesel Engine advancement ever attained in the United States — The BUDA - LANOVA "SILVER CROWN" DIESEL ENGINE!

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- Perfect combustion under all conditions
- Low pressure injection. No flame strikes piston or cylinder walls
- High *Workable* Mean Effective Pressure

These advantages mean a new smoothness of operation, higher efficiency, reduction in wear and tear and lower overall costs for the boat owner!

Before you buy a Diesel engine send for complete details on this champion of Diesels.

BUDA — the choice of the U. S. Navy! Before buying a Diesel Engine every one should read this interesting booklet, "How the U. S. Navy Determined Its Diesel Engine Requirements, for Ships' Boats." Free, of course.

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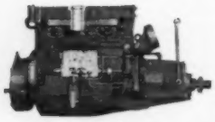
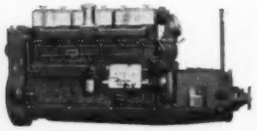
BUDA SILVER CROWN MARINE ENGINES

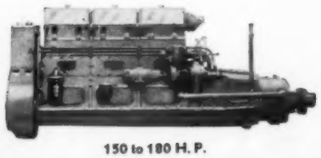
32 to 40 H. P.



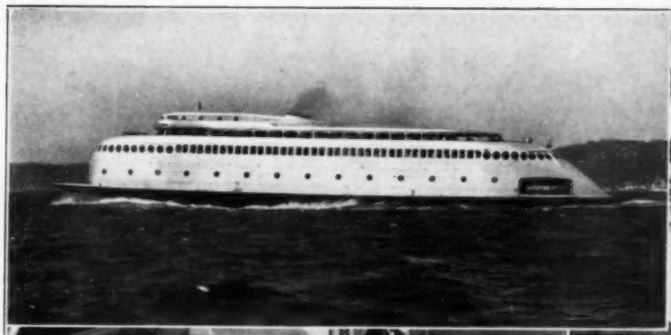
85 to 110 H. P.

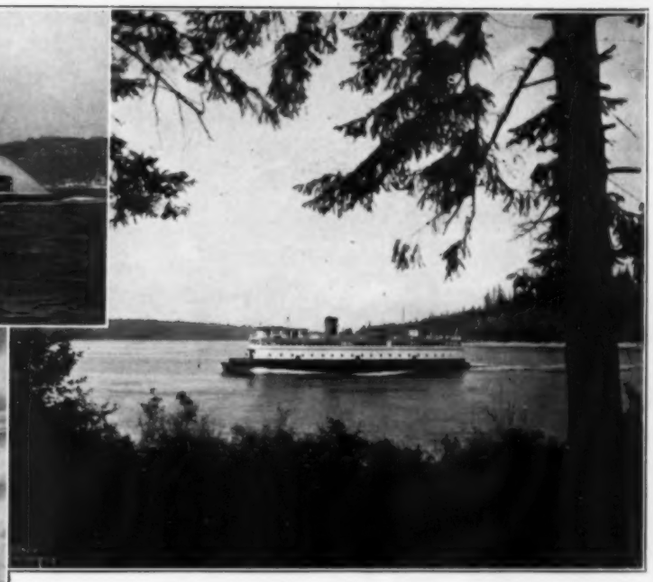


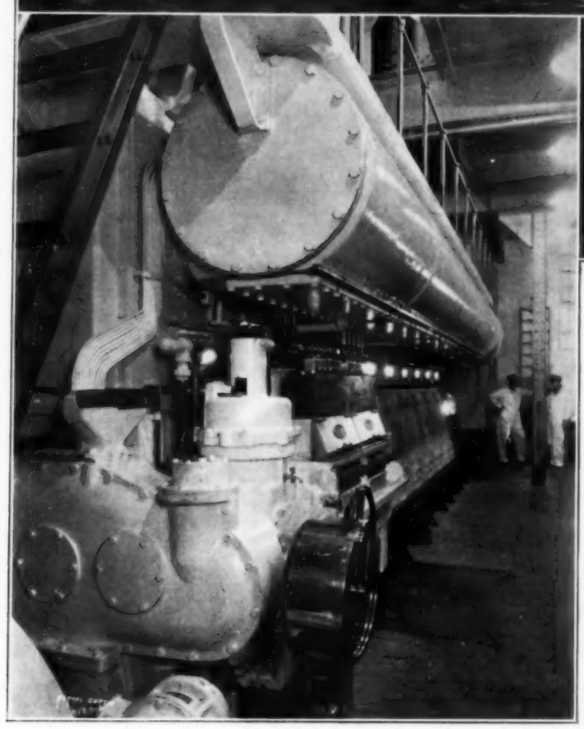
112 to 150 H. P.



150 to 180 H. P.







First the *Chippewa* Then the *Kalakala*

WHEN the ferryboat Chippewa (shown at right above) was converted from steam to Diesel power, the owners, the Puget Sound Navigation Company, selected "Alnor" Exhaust Pyrometers to safeguard the engines.

With the installation on the Chippewa proving highly satisfactory, it was but natural that when the Peralta was rebuilt into the modern Diesel streamliner and renamed the Kalakala, (shown on the view at upper left) the "Alnor" Pyrometer should again be chosen.

Both of these ferryboats are powered by Busch Sulzer Diesel engines. A section of the engine room of the Kalakala is shown in the lower left view.

"Alnor" Exhaust Pyrometers are especially suited for marine service. A choice of three waterproof types for permanent mounting is offered, in addition to a portable type for small marine Diesel engines. Other units not waterproof but which are splashproof are also available.

Alnor Exhaust Pyrometer like one installed on Kalakala

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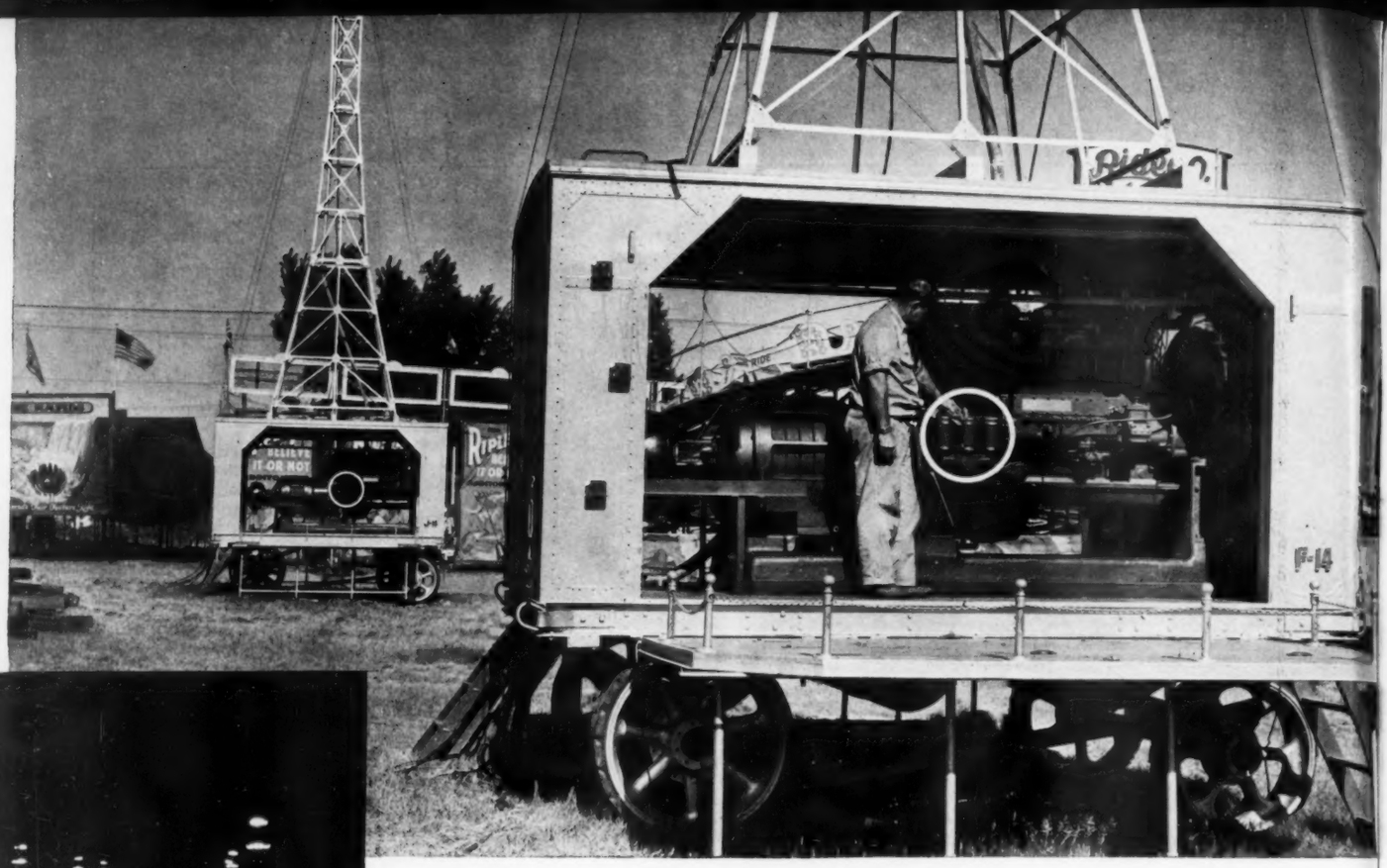

THESE DIESELS NEVER LET THEM DOWN

The story of America's carnival spirit is the story of light. Intensive illumination always draws the crowds, and what they find thereafter continues to require golden floods as they seek amusement and diversion.

Royal American Shows has everything. It is a modern midway that would do credit to any national fair...Its lighting is positive and successful...and its use of the Caterpillar Diesel Engine for this purpose strikes the latest, most modern note.

Night after night, Royal American Shows' portable electric plant...consisting of six 125 H.P. Caterpillar Diesels, each directly connected with a 60 K.W. G. E. generator...and a seventh of the 120-208 three phase type...furnish a steady flow of current to every section of the show area.

It speaks well for the Caterpillar Diesel to be selected for such an important job.

And it is another natural sequence that a company of this character should use Purolator Oil Filters for the protection of both fuel and lube oils.

Purolator Filters are very frequently found on Diesel engines charged with important work. There is a Purolator for every type of Diesel, and your inquiries are solicited by the Purolator engineering staff. Motor Improvements, Incorporated, 365 Frelinghuysen Avenue, Newark, New Jersey, makers of the

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The Oil Filter

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- ✔ LIGHTER WEIGHT
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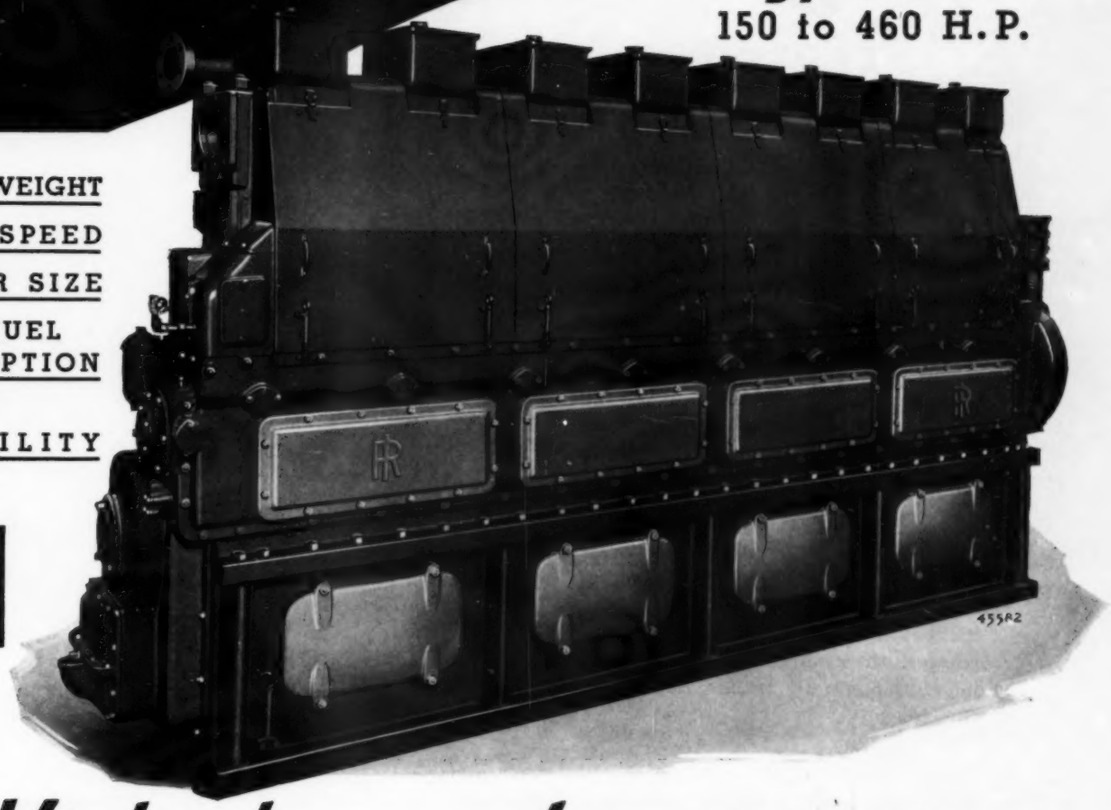
- ✔ SMALLER SIZE
- ✔ LOWER FUEL CONSUMPTION
- ✔ PROVED RELIABILITY



With these advantages

1. Modern Design—Type S engines have such modern features as full enclosure of the engine, cylinder liners, and full force-feed lubrication. They follow the modern trend to higher speeds and lighter weight but without sacrificing reliability.

2. Lower Fuel Consumption—As low as that of the largest slow-speed engines and about 25% lower than that of high-speed automotive type engines.

3. Lower Installation Costs—The Type S weighs less and requires less space and smaller foundations than slow-speed engines. Installation and transportation costs are therefore much lower.

4. More Efficient Power Transmission—The higher speed makes possible less costly and more efficient generators. Better pulley and gear ratios are possible for most installations.

5. Inexpensive to Maintain—The unit is built for heavy duty service. Records prove its low maintenance expense.

6. A Thoroughly Proved Engine—More than 140 I-R engines of the same bore, stroke and speed are in successful service. Some of these have been in service for 12 years.

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No. 2 of a series showing the scope of Westinghouse Electrical Applications in Diesel Power Plants.

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★ You can't go wrong when you delegate to Westinghouse full responsibility for the complete electrification of your Diesel Power Plant. By so doing you gain a double advantage:

(1) That of securing *matched equipment* . . . every electrical unit in the installation built to a single standard of quality; and

(2) That of insuring *a dependable follow-through* after the installation . . . which solves once and for all the problem of equipment maintenance.

Since the earliest days of the Diesel engine, Westinghouse has specialized in the production of generators and complete electrical auxiliaries to fit all types of Diesel Engine drives. Case studies of actual installation performance attest the success of this program . . . prove that when you delegate full responsibility to Westinghouse you can't go wrong!

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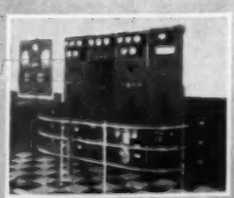
Westinghouse engine-driven generators and electrical auxiliaries, are manufactured to a single standard of quality for matched performance.

ES GENERATORS—Especially designed for lifetime operation in Diesel Service, with these extra values: *Solid Steel Rotor*, to withstand severest stresses under all conditions. *Protection against Shut-downs*, insured by exclusive high frequency pre-testing. *Positive Ventilation*, for cool running and long life.

EXCITERS—Either direct-connected or belt-driven, as required.

MOTORS—With dual-protected windings, rigid cast frames, and sealed-sleeve bearings . . . for driving compressors and other auxiliaries.



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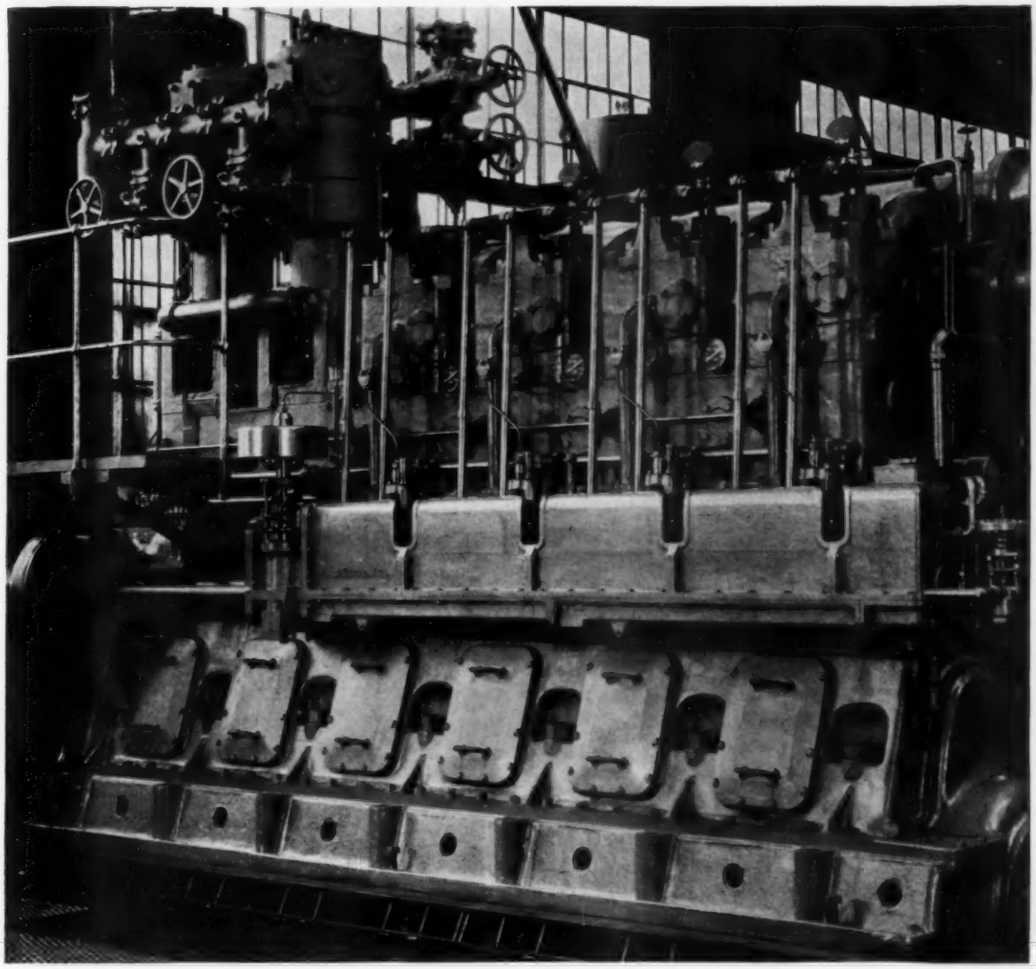

Nonpareil Diesel Oil Medium

—a highly refined pure mineral oil of exceptional cleanliness. Has proper body and quality to lubricate both the power and air cylinders of several types of Diesel engines. Will reduce bearing friction to a minimum where the lubricating system is designed to use the same oil for power cylinder and bearing lubrication. Zero-pour point and low temperature viscosity characteristics make it ideal for winter use.

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—recommended for most Diesel engines. Extreme cleanliness remarkably combined with heavy body. Excellent stability and a good rate of separation from water so that it may be used for both cylinder and bearing lubrication. Greatly reduces carbonization and gumming around rings and piston skirt. Also reduces the amount of carbonaceous deposits formed in exhaust passages and changes their character to a softer, less harmful form.

Nonpareil Diesel Oil Extra Heavy

—developed especially for certain types of heavy duty, two cycle engines and is also serviceable for four cycle engines operating under severe conditions where a special heavy-bodied oil is required.

Not only MAINTENANCE, but FUEL CONSUMPTION and POWER as well!

ALL *three* are directly affected by Diesel lubrication. Naturally, the choice of the proper quality and grade of oil is highly important. Find out, before you choose, how superior *Nonpareil Diesel Oils* are. Call your local Standard Oil (Ind.) office. Let a Standard Oil engineer help you pick the most suitable grade. Then make an actual service test with Nonpareil!

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He not only knows Texaco Lubricants and how to apply them, but he has also had a broad knowledge of Diesel engine operation.

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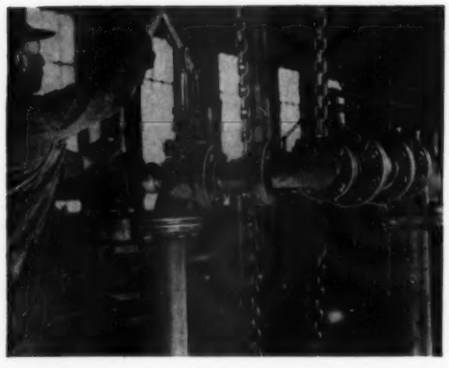
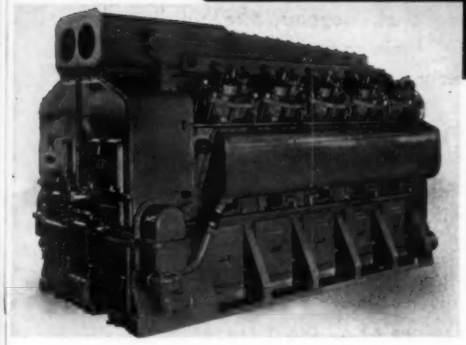


TEXACO LUBRICANTS

FOR ALL TYPES OF DIESELS

ERIE

Because of long years of experience an ERIE crankshaft was again selected by Busch-Sulzer Bros.-Diesel Engine Company for the largest and most powerful locomotive Diesel.



CRANKSHAFTS

The Busch-Sulzer Diesel Engine for Illinois Central transfer locomotive is the largest yet produced for railroad service. It is but logical that the crankshaft for this engine should come from ERIE, who manufacture a majority of the Diesel engine crankshafts. For many years past, in fact, since the inception of the Diesel engine use in this country, the leading engine manufacturers have relied on us for their crankshafts.

ERIE FORGE COMPANY

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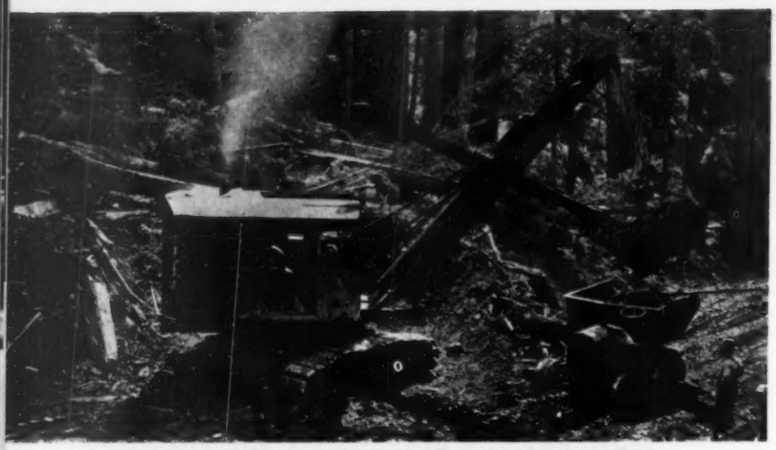
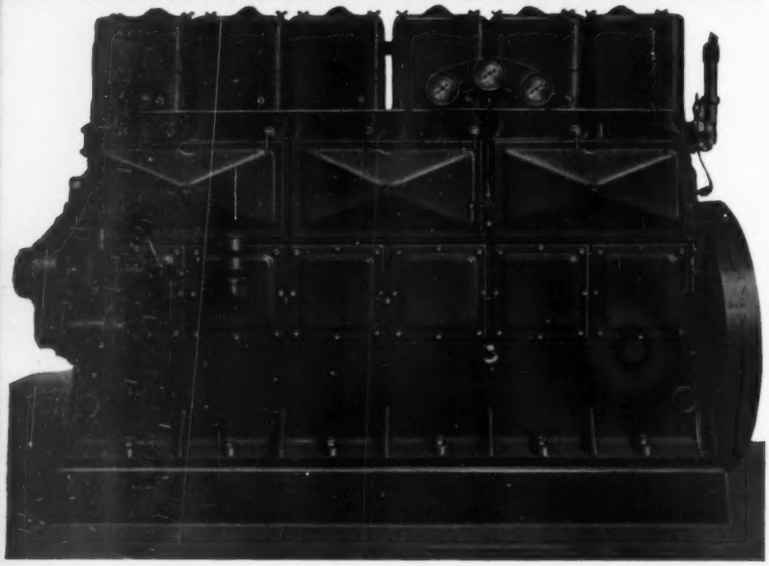
5 Atlas Diesels dig 175 Miles of Logging Road





OUT in the Pacific Northwest, extensions of logging railroads are continually being made in advance of the loggers so that when one stand of timber has been harvested, the logging railroad will have been built to haul to the mill the logs that a new stand will yield. Most of this construction is in mountainous areas where the going is mighty tough.

During the past eight years, five Atlas Diesel powered P. & H. Shovels have excavated 175 miles of such logging road for the largest lumbering operation and logging show in the Northwest. The first two shovels were bought in 1927, two more were put to work in 1928 and the fifth went into the woods in 1929. All have worked continuously, and about half the time on double shift.

All of their work has been hard construction, a great deal of it through solid rock—just the kind of work it takes to show what shovels are made of. Loggers, like building contractors, do not "baby" their equipment. It has to be able to "take it" if it is to stay in the woods.

The performance of these five Atlas Diesel powered shovels has been outstanding, their operating cost has been low and maintenance negligible. Besides these tangibles, Atlas Diesels do not emit flying sparks that start forest fires, nor do they present the water problem that is always incident to steam rigs. The trend in the woods is definitely toward Diesels and in power excavators you'll find more Atlas Diesels than the engines of all other Diesel manufacturers combined. Write for a copy of our catalog which covers the application of Diesel power to nine specific industries.

ATLAS IMPERIAL DIESEL ENGINE COMPANY
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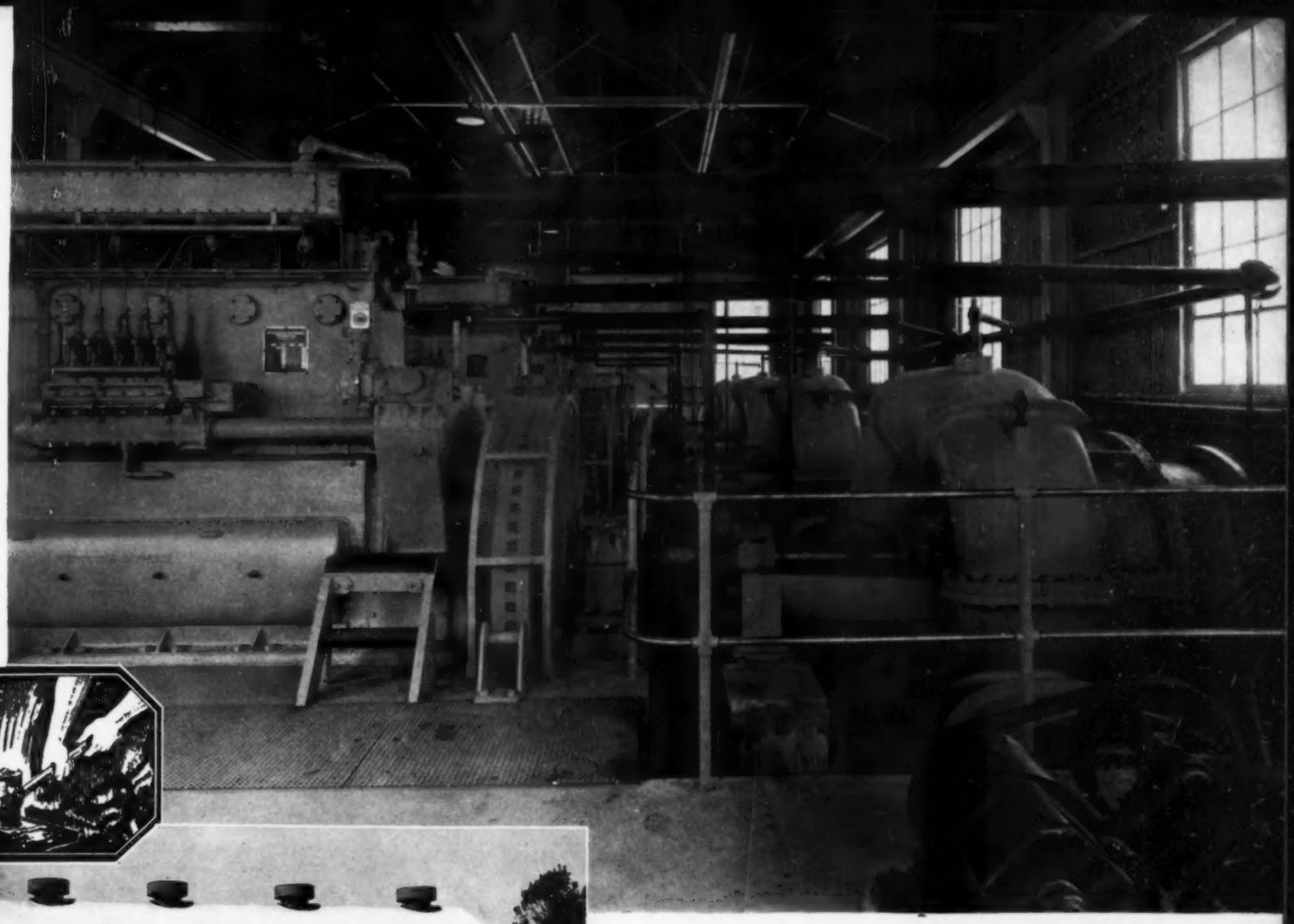
ATLAS IMPERIAL



The rice growers of southeast Texas are using water supplied by the Orange County Water Company. This concern operates four McIntosh & Seymour Diesels, 5 cylinder, 12½x22," rated at 400 bhp. These engines drive four Morris Machine Company 48" screw pumps which pump 228,000 gallons of Sabine River water per minute into a canal, 22 feet above the river level. The water is then distributed by gravity over wide acreages to neighboring rice growers. The M & S engines are equipped with Satco lined bearings.

The complete modern pumping plant, was designed and built by the Transamerican Construction Company.

Growth

GROWTH is not a product of chance . . . in the rice field or in the Diesel field. The Diesel has succeeded because it was brought along carefully and scientifically. It has reached a point where it can demonstrate its capacity to handle all sorts of power jobs efficiently.

In outstanding Diesel plants the country over, locomotive and stationary, you will find Satco* lined bearings of our manufacture. Diesel builders and operators have learned they can depend upon Satco metal to stand up under loads and speeds and stresses that would cause less sturdy alloys to fold up and call quits.

If bearing problems threaten to hamper the growth of your Diesel business, we will welcome a chance to suggest solutions.

*A patented alloy manufactured by National Lead Company. Trade Mark registered.

AMERICAN BEARING CORPORATION

Affiliated with National Lead Company

INDIANAPOLIS CENTRIFUGAL American Bearings FORCE **INDIANA**

The New INTERNATIONAL PD-80 Power Unit — the Only 6-Cylinder Diesel That Can Be Cranked by Hand

WITH the introduction of the new Model PD-80 Diesel Power Unit the valuable features of International Harvester Diesel Engine design have become available to many new users of heavy-duty power. This big 6-cylinder engine, with its 4¾" bore and 6½" stroke, develops a maximum of 100 hp. and delivers 80 hp. under continuous load. It provides ample power for the operation of big-capacity pumps, electric generators, sawmills, cotton gins, rock crushers, gravel-washing plants, conveyors, etc.

The new International PD-80 starts as a conventional gasoline engine and is as easy to crank as any gasoline engine of its size. After the engine has warmed up for two or three minutes the operator easily converts it to full Diesel operation by turning a conveniently placed crank one-quarter turn. Even in the coldest weather the engine parts are thoroughly warmed during this starting period, assuring full heat from compression to give a snappy Diesel start and efficient Diesel operation.

The new Model PD-80 is the latest addition to a line of power units ranging in size from 12 hp. to more than 100 hp. (including a 4-cylinder Diesel) — all built to the traditional International Harvester standard of quality and backed by a nation-wide network of dealers and Company-owned branches. The International Industrial Power line also includes TracTracTors in three sizes (one a Diesel) and five Wheel Tractors (one a Diesel) for all kinds of work. For complete information call on the nearby branch or dealer, or write us.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
606 So. Michigan Ave. Chicago, Illinois

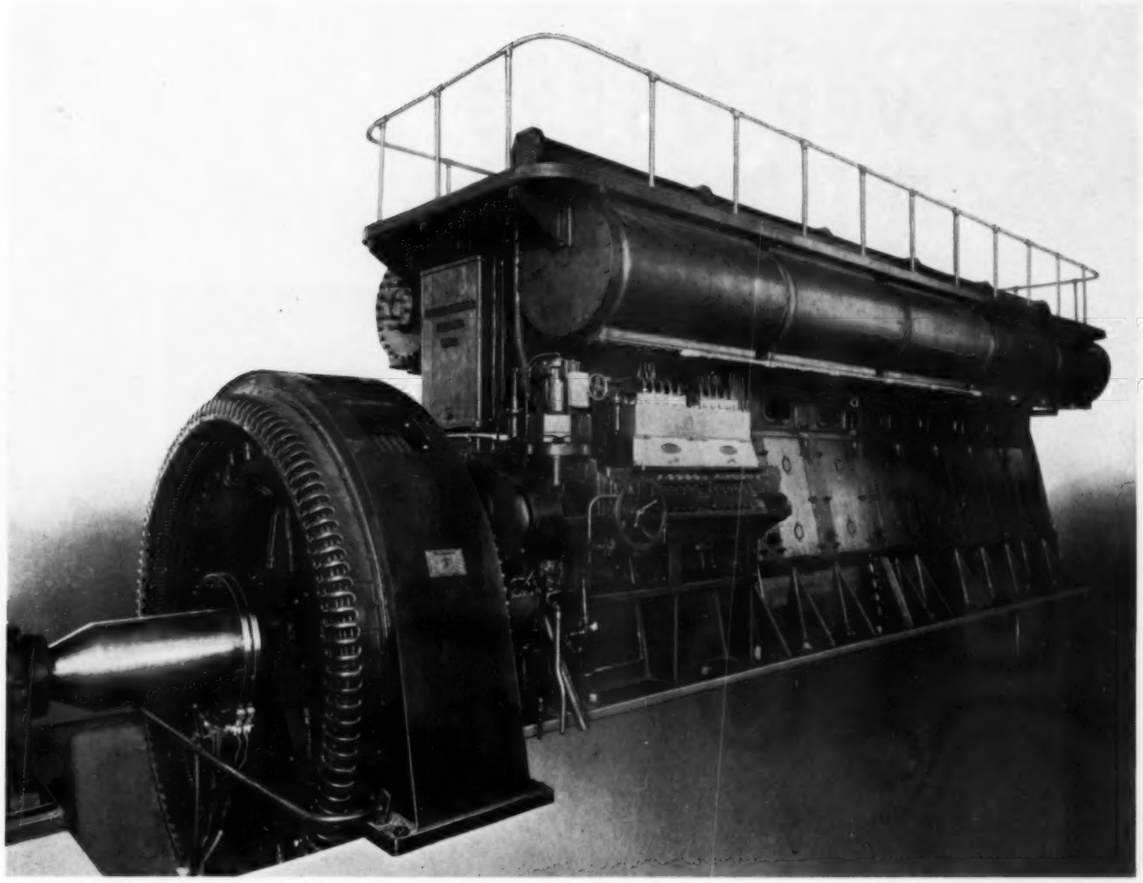
Left: The PD-80 operating a sawmill. It provides sufficient power for a sawmill with a capacity of 11,000 to 22,000 board feet in 10 hours—an example of the amount of work that can be done by this new International Diesel.

SPECIFICATIONS
International Model PD-80

Maximum Horsepower (corrected to sea level barometric pressure and 60 F — power unit fully equipped)	100
Horsepower, Continuous Load (80% or Maximum Horsepower)	80
Number of Cylinders	6
Bore and Stroke, inches	4¾ x 6½
R.P.M.	1400
Clutch Diameter, inches	15
Clutch Torque, pound-feet	785
Flywheel Housing	S.A.E. No. 1
Fuel Used	Diesel Fuel
*Belt Pulley Diameter, inches	12
*Belt Pulley Face, inches	13
*Belt Speed, feet per minute	4398
Overall Length, inches (including starting crank but not belt pulley)	98¼
Overall Width, inches (24-inch turning radius of starting crank not included)	41
Overall Height on welded steel base, inches	66¼
Approximate Weight, fully equipped including welded steel base, pounds	3750

***Belt pulley is special equipment—other sizes available**

INTERNATIONAL HARVESTER



Modern 3000 B.H.P. Busch-Sulzer Diesel

38 YEARS EXPERIENCE

Knowledge gained through longer experience in building Diesels than that of any other American builder has been applied in the development of modern Busch-Sulzer Diesels for stationary, marine and locomotive service. . . . . .

Sizes 225 to 10,000 B.H.P.

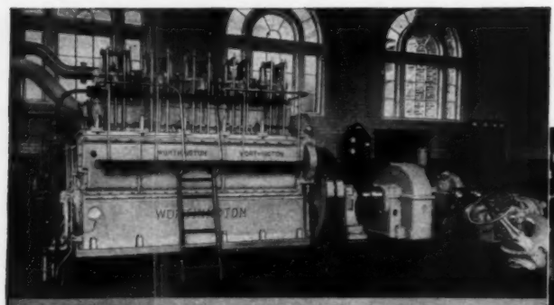
BUSCH-SULZER

BUSCH-SULZER BROS.-DIESEL ENGINE CO.
ST. LOUIS, MISSOURI

First Diesel to be placed in commercial service in the world. 60 H. P. Built at St. Louis—1898

For POWER USERS

in every service



WATER SUPPLY

250-hp. Worthington Diesel Engine driving Worthington Centrifugal Water Works Pump

MUNICIPAL POWER

675-hp. Worthington Diesel driving generator on municipal power and light service

MINING

625-hp. Worthington Diesel on power generating service in manufacturing plant

Eight Worthington 625-hp. Diesel Engines on power generating service for mining operations

MANUFACTURING

25 to 1500 horsepower

...WORTHINGTON DIESEL ENGINES

are demonstrating their reliability, flexibility and over-all economy

BUILT by an organization unsurpassed in its ability to correctly analyze any power problem . . . with more than 35 years of successful engine building experience to support its recommendations.

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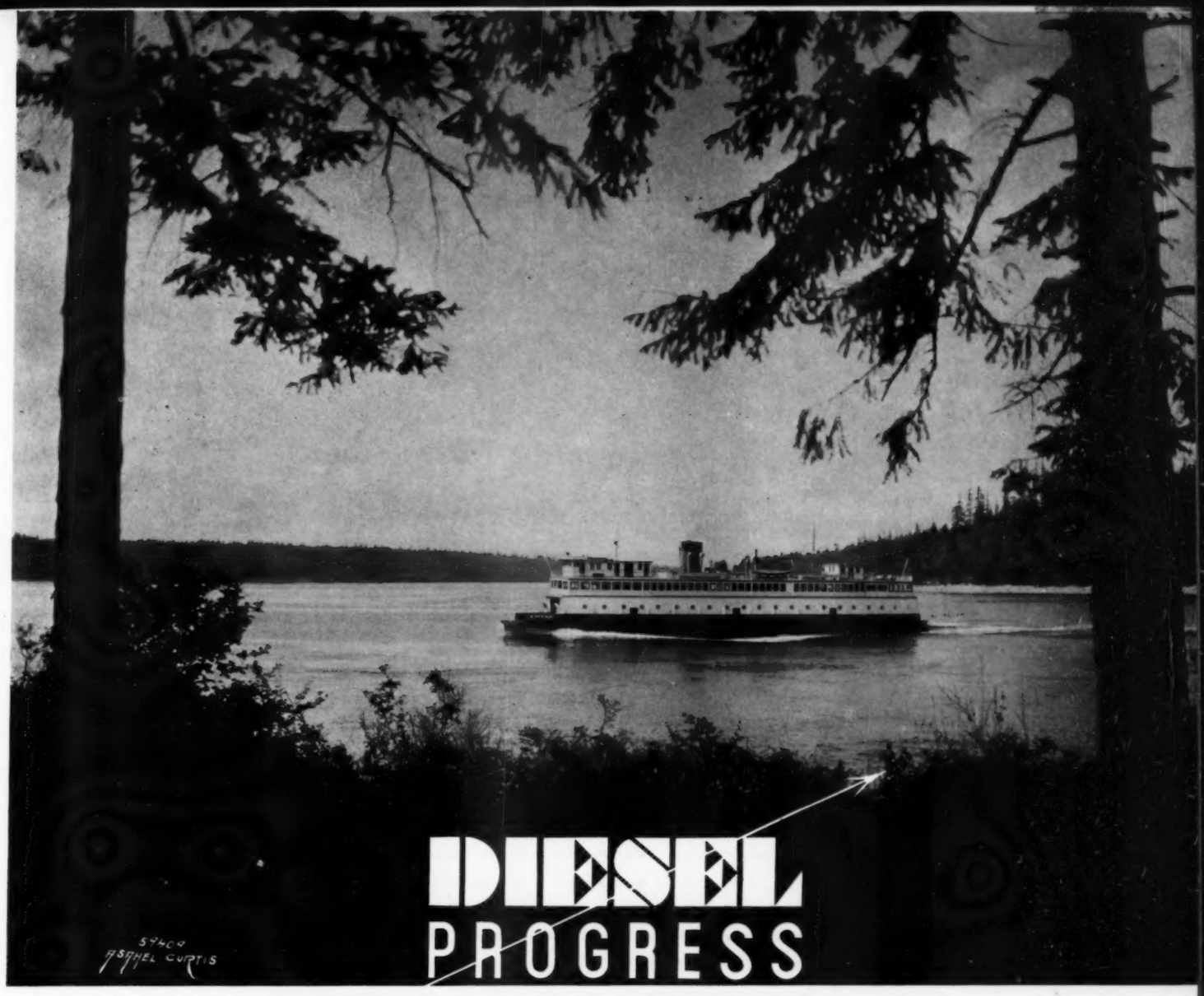

CONTENTS for SEPTEMBER

FRONT COVER ILLUSTRATION – *Escape*, auxiliary schooner, powered with a two-cylinder, 25 hp. Fairbanks-Morse Diesel engine. Photograph by Morris Rosenfeld.

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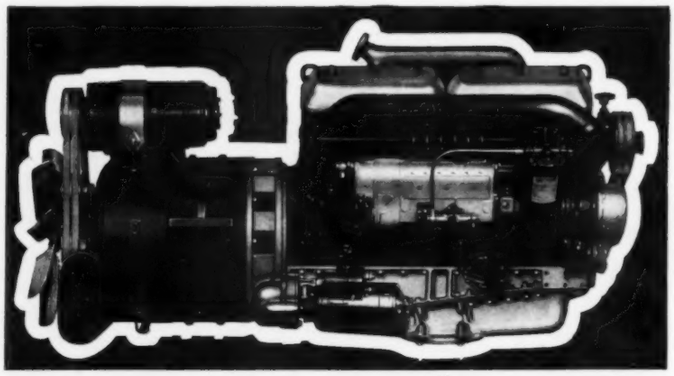
HERCULES ENGINES POWER DIESEL ELECTRIC TRANSIT COACHES

PROGRESS—The Yellow Truck and Coach Manufacturing Company—the world's largest bus manufacturer—has selected the Hercules Diesel as power for its new Diesel electric buses, a large fleet of which are being built for Public Service Coordinated Transport of New Jersey. The new 36-passenger transit coach has passed all of Public Service's drastic tests, and a new era in efficient, low-cost, comfortable and safe passenger transportation has begun. Hercules is gratified that its advanced engineering has contributed so materially to the development of these new Diesel electric vehicles.

The Hercules DRXB 4⅜ x 5½, 6-cylinder, high-speed, heavy-duty Diesel Engine with modern electric generator.

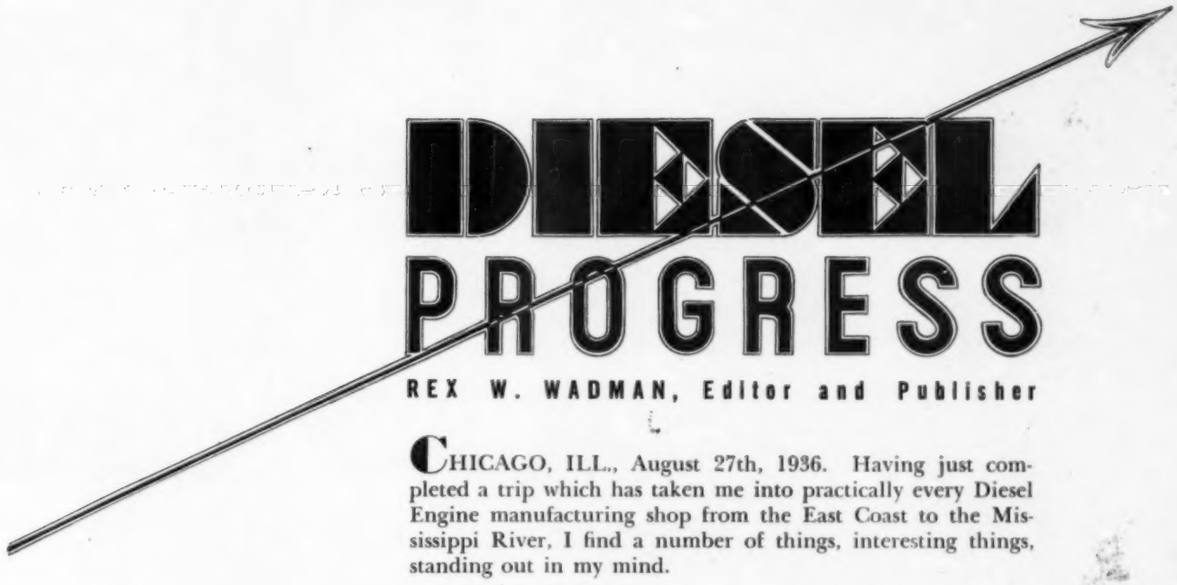


This installation is mounted transversely in the rear of the new Yellow Coach Diesel electric bus shown above.

HERCULES DIESEL ENGINES

HERCULES MOTORS CORPORATION, CANTON, OHIO

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.



DIESEL PROGRESS

REX W. WADMAN, Editor and Publisher

CHICAGO, ILL., August 27th, 1936. Having just completed a trip which has taken me into practically every Diesel Engine manufacturing shop from the East Coast to the Mississippi River, I find a number of things, interesting things, standing out in my mind.

One is that uniformly and universally the engine shops are busy, most of them working night shifts. In every case, with one exception, each manufacturer is carrying on his books to-day a greater back log of unfilled orders than ever before in the history of the Diesel industry.

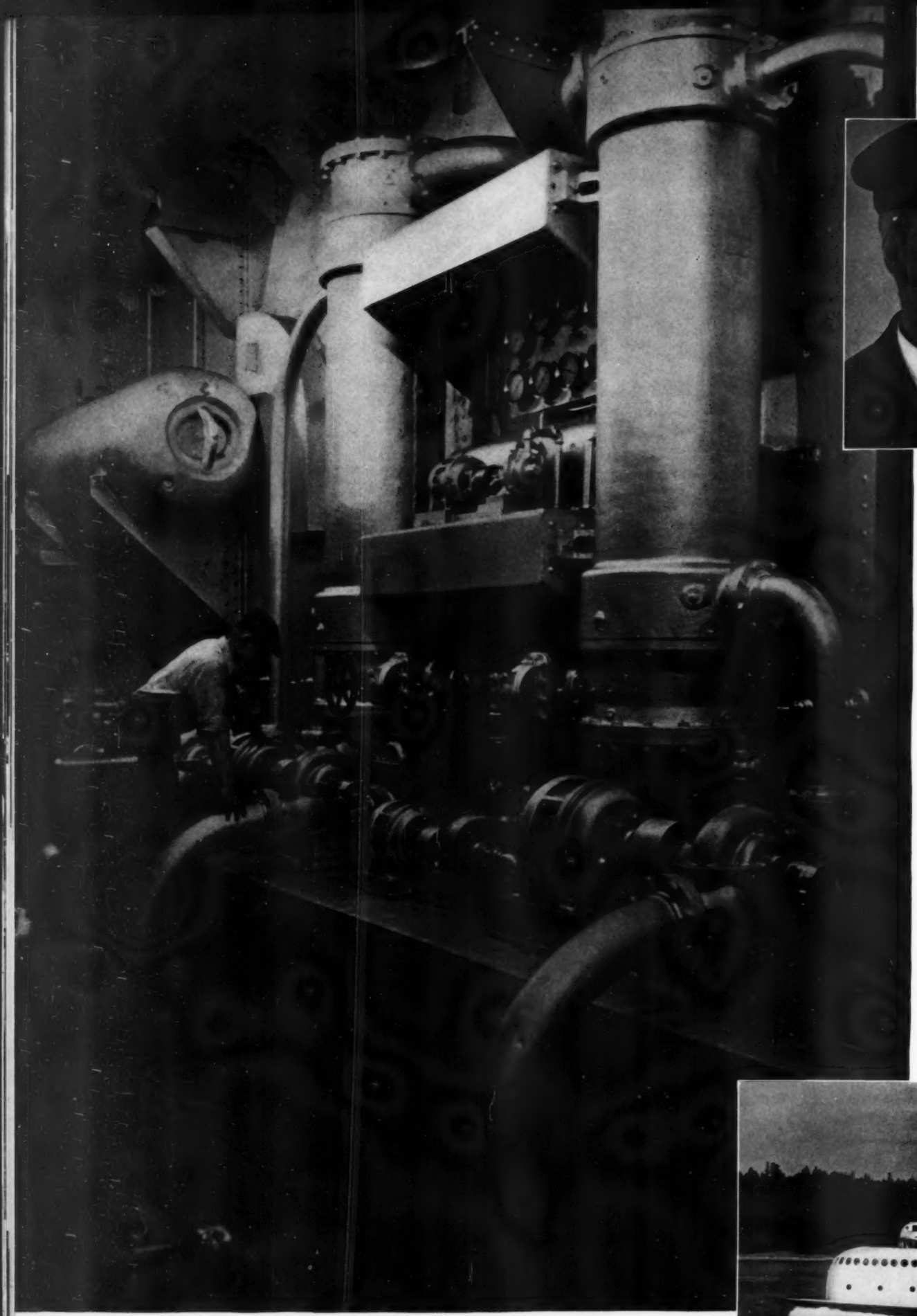
Whilst we produced in this country last year approximately one and a quarter million horsepower of Diesel and Oil Engines, tentative figures for the first six months of this year show that we have already shipped one million horsepower and the year only half over.

Another outstanding fact I discovered on this trip is the tremendous amount of development and research work going on in the engineering departments. More new engines on the boards, more new ideas being tried out than ever before in my memory. The next few months will see some mighty interesting announcements from several sources. 1936 will go down into history as a year of new models, new developments, progressive advancement.

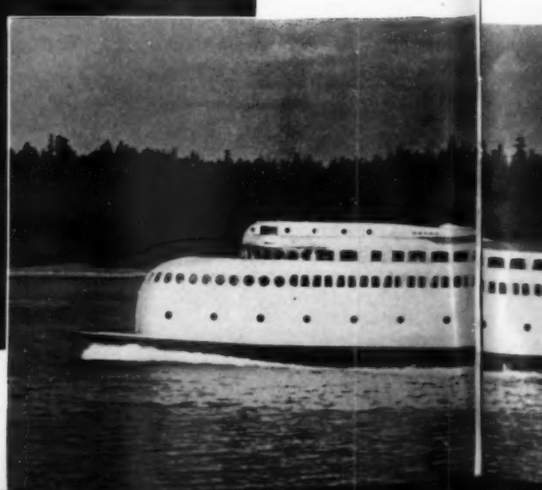
But possibly the most interesting fact brought out in this trip is the width, depth and breadth of the application of Diesel engines which are being made this year. In every industry, in every state and almost in every city, town and hamlet, a Diesel installation has been successfully made this year. Many a new market has been opened up this year, many a new application, hitherto considered impractical, has been made and made to stick by the pure economic figures of the savings produced.

The better understanding our whole industry has of heat recovery, both from exhaust and jacket water, has opened up many new applications and as we develop a larger background of experience along these lines, other applications will become practical. All in all the Diesel Industry is *on its way*.

Rex W. Wadman



Chief Engineer Albert Thornton of the Diesel Ferry "Kalakala."

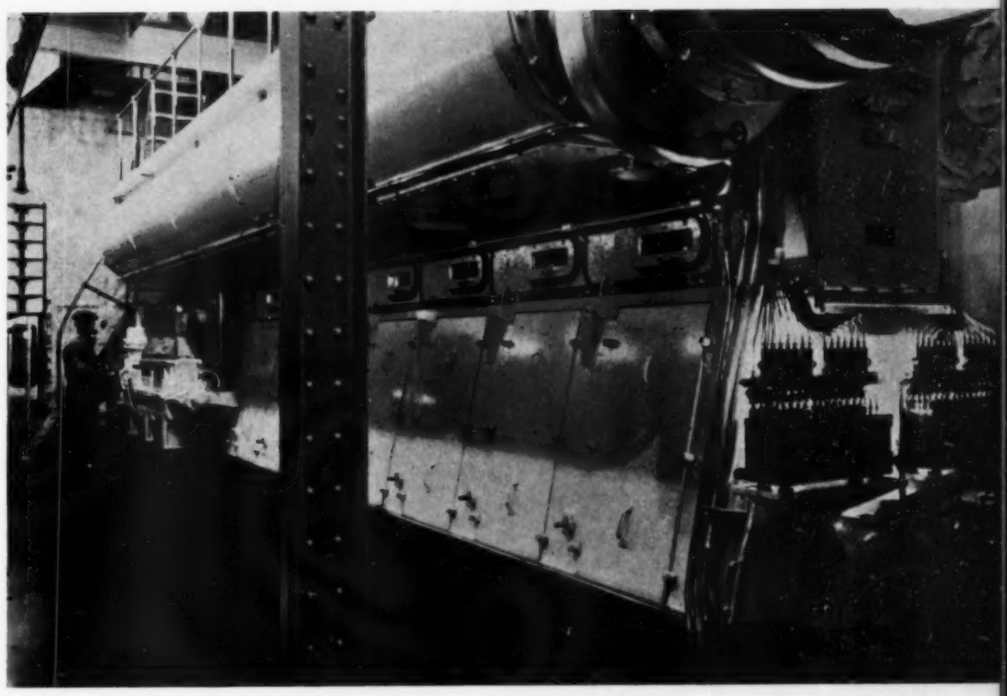


Photographs by A. A. Tacchella

KALAKALA AND CHIPPEWA

By CHARLES F. A. MANN

AMERICA'S two finest and fastest Diesel powered ferries, the world-famous *Chippewa* and the equally famed streamlined ferry *Kalakala,* both operated by the Puget Sound Navigation Company between Seattle and Bremerton, Wash., are grinding out an operating schedule of nearly 500 miles per day, swiftly approaching all world records ever piled up by a pair of Diesel driven vessels.



At the time of her being commissioned as a Diesel ferry in May, 1932, the *Chippewa* (see Table of Contents illustration) had completed 30 years' service on the Great Lakes and Puget Sound as a 1,500 hp. steam vessel using from 120 to 135 bbls. of fuel oil per day on comparable mileage, at a speed of 13½ knots. Her unusual steel hull was sponsoned twice and upper works rebuilt into America's most luxurious ferry, and a 2,130 hp. 8-cylinder Busch Sulzer 2-cycle trunk piston main engine and a 375 hp. 5-cylinder 4-cycle Busch Suzer auxiliary engine, driving the electric generating set for scavenging blower and hotel load, fitted, increasing her speed to 16 knots and showing a drop in fuel consumption down to an average of 51 bbls. per day, at eight round trips per day, or 248 miles.

The *Kalakala,* the world's first completely streamlined vessel, laid out by Helmuth W. Schmitz, the first Naval Architect to develop and finish a streamlined boat, was commissioned July 2, 1935, with a power plant consisting of a 3,000 hp. 10-cylinder Busch Sulzer main engine and a 600 hp. 8-cylinder Busch Sulzer auxiliary, having same cylinder dimensions and features of design as the power plant in the *Chippewa.* The *Chippewa's* record of performance was the sole deciding factor in the choice of the *Kalakala's* power plant, being the judgment of the largest and oldest operators of commercial and passenger vessels on inland waters on the Pacific Coast, having nearly a half-century of experience with every conceivable type of power that could be used in a ship.

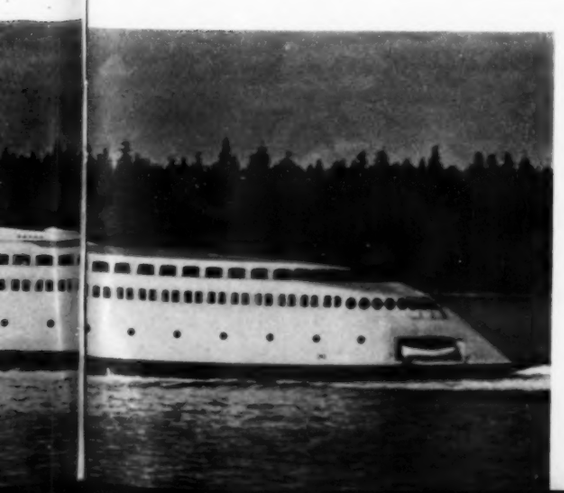
So many unusual features attend the operation of this pair of luxurious ferry boats that a volume could be written on their record of performance on this difficult run, where ferries, in order to maintain fast schedule in the swift currents of Puget Sound and buck the sometimes huge logs that smash the bow structures and bend running gear, must be single-enders of very large capacity and make a complete turn-around on each round trip. Strangely, too, almost the same identical conditions govern the operation, speed, costs, capacity and general setup of this unique ferry run, as govern the use of two super-sized, very swift liners on the North Atlantic runs. It is either a case of having two boats of high speed and unusual dependability or three or more slower vessels at a greater total daily cost than for the two faster boats.

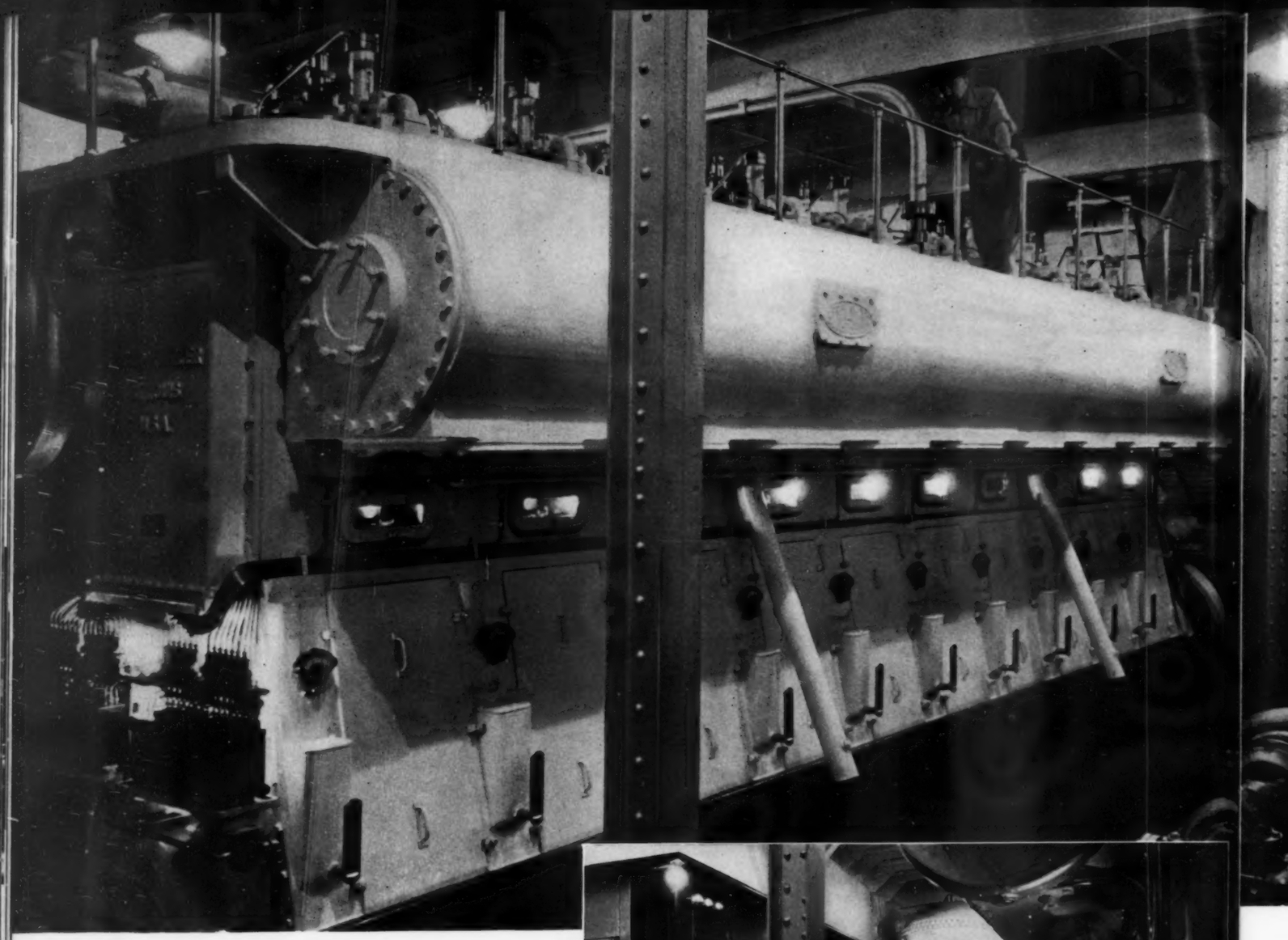
This factor alone gives rise to exacting demands on the power plant which keeps them going 365 days per year and all but four hours during each 24, at a pace which makes even bottom painting a time schedule race between sunset and dawn when the humidity is low and the wind just right for drying the hull and paint before dropping her off into water for a race for the 6:30 trip from Seattle to Bremerton.

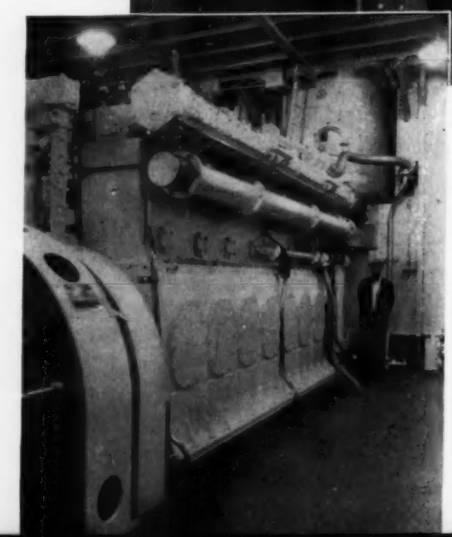
On September 1st, the *Chippewa* will have crossed the 400,000 mile mark on her record as a Diesel ferry. On that date the *Kalakala* will have finished her first 100,000 miles.

The *Chippewa* and *Kalakala* may be treated together in summarizing their record of operation, keeping in mind that their power plants are identical in design, only a greater number of cylinders in the *Kalakala,* and the difference in their total mileage. The remarkable factor is the *Chippewa's* 400 per cent longer running

Engineer Thornton Diesel Kalakala."







period, yet no difference in the record of wear, breakdowns, replacements and delays.

Neither engines have had new liners, have been rebored, have had new pistons or any grinding done on the crankshaft. Outside of changing the rings, on a gradual replacement basis, on the main engines, and replacement of rocker arms early in her operation on the *Chippewa*, the auxiliaries have given no trouble.

As yet, neither main nor auxiliaries have had a complete replacement of rings. There are six rings per cylinder in each main engine American Hammered and Busch-Sulzer makes. Each complete piston is pulled on regular schedule, shutting down the power plant at 1:45 in the morning, lifting cylinder cover and loosening connecting rod bearing, then hoisting entire assembly out the top and placing new assembly and having the engine ready to go in three hours. A plate in the scavenging

The ten cylinder, 3,000 hp. Busch Sulzer main Diesel engine and switchboard of the "Kalakala." Left — The 600 hp. eight cylinder Busch Sulzer Diesel auxiliary.

air receiver next to the air inlet ports is removed and a complete inspection of rings and cylinders made twice each month. Lube oil is centrifuged six times per day by a Delaval system and the original oil in the *Chippewa*, placed five years ago, is still there! A Busch Sulzer wire filter is also used. The *Chippewa* uses 18 gallons of lube per day and the *Kalakala* about 25, and all oil and water cooling circuits for pistons, lubrication and jackets are held at an inlet temperature of 95-100 degrees, by means of closed circuit cooling systems using salt water in copper tubed intercoolers. Maneuvering by compressed air incident to these difficult runs has proven swift and never-failing and far faster than steam. Both boats maneuver 16 times per trip and 128 per day.

The *Chippewa* has made nearly 400,000 maneuvers and never failed to respond in all the time she has operated. A single failure on the lone main engine might spell disaster. The The turboblower scavening air system maintains 2¾ lbs. pressure in the receiver at all times, when stopped or at any speed range. Jacket water from the auxiliary, started 30 minutes before the main engine, is circulated through the main engine to bring it to operating temperature so instantaneous running at full speed is possible, with little wear on the engine cylinders and bearings. This procedure accounts for the remarkably little wear accounted for.

These vessels carry heavy loads of foot passengers, autos, trucks, freight drawn on trailers by gas tractors and mail four times per day. There can be no skipping a trip for a single cause on a run like this, because no other boats on Puget Sound could be put in their place.

Fuel valves are rotated with a spare so as to give a complete fuel valve change and cleanup twice per month. The same fuel pumps and injection systems that came with the engines when new are operating today. The auxiliary heating boiler and pumping system has had a like record.

The *Kalakala*, because of her unique design, has brought out some practical points in favor of extremes of streamlining that are startling in their conclusions. Her upper works are entirely of sprayed aluminum paint, eliminating all trim and all second color to be applied by hand. So remarkably has this worked out that on June 20 she was taken out of service for one day and given an entire coat of fresh paint in nine working hours. The 50 gallons of aluminum paint cost $135 and the labor $260, or a cost of half that of painting and varnishing the *Chippewa*, 33 per cent smaller in size! No stacks, masts, guywires, taff railing, sash trim, ventilators or projections of any kind. Half the vessel can be sprayed before lunch!

Drydocking of both vessels for bottom painting and rudder and propeller work is arranged for a clear night when the humidity is low. They are withdrawn about 7 P.M. at the end of a "short" trip-day and taken to Todd's Seattle Drydocks, Inc., and lifted clear. The hull is dried, inspected and painted and any adjustments made in running gear or rudders, etc., is made and the whole operation performed and the vessels dropped back into the water before 5 A.M. This is how they keep 'em going 365 days per year.

The sprayed lacquer finish used on the interior of the *Kalakala* has proven its worth. A whole deck can be redecorated in one day with the sprayed colors, and they wear well in all weather. The waste heat boilers supply plenty of steam for heating, hot water and cooking in all weather except sometimes in winter, when the boiler has to be externally fired.

The *Kalakala* uses about 45 barrels of oil per day on seven round trips and the *Chippewa* around 42 barrels on eight round trips. Careful check shows fuel consumption for both main engines at .38 lbs. per hp. hour and for the entire main and auxiliary load from .40 to .41, depending on electric and heating load and variation in amount of power used at night when auxiliary is running but main engine shut down during piston-pulls.

People have come from every part of the world to ride on the *Kalakala* and *Chippewa* — one way on each boat — and marvel at the luxury found on these vessels, the two finest ferries in the world from standpoint of accommodation. Operating men and engineers have likewise come from every part of the world to study the mechanical setup. Capt. Alex Peabody, president of the company, and James E. Murphy, Marine Superintendent for P.S.N., showed a lot of nerve to pioneer this unique pair of boats. But in reward for their nerve, they have saved thousands of dollars in their monthly expenses and set a pace no other operator dared set before.

Since the merger of the Kitsap County Transportation Company with P.S.N. last spring, the company is now the largest Diesel ferry boat operator in the United States, if not the world.

To help our readers refresh their minds regarding the *Kalakala* and for the benefit of those who did not have an opportunity of seeing the original description of this remarkable vessel which appeared in the August, 1935, issue of DIESEL PROGRESS, a short resumé of her history and construction follows.

Oringinally, of course, this vessel was the *Peralta*, a turbo-electric ferry built in 1927. She was partially destroyed when the Key System's Oakland mole burned but fortunately her hull was not damaged.

In 1933 the Puget Sound Navigation Company found that increased business justified another ferry on the run between Seattle and Bremmerton in which the highly successful Diesel *Chippewa* was operating. In fact, it was the *Chippewa's* record which led to the decision to recondition the old hull with Diesels instead of using the former steam turbine machinery which was found to be undamaged.

Accordingly, the novel stream-lined design was developed and the work completed. The result is well known. The main propulsion engine is a ten cylinder, two cycle, Busch-Sulzer Diesel which develops 3,000 hp. at 250 rpm. Likewise, the auxiliary engine is also a Busch-Sulzer Diesel of eight cylinders driving a 440 volt alternator. By means of transformers all power and lighting circuits take current directly from the main generator or shore outlets.

As is evident from the foregoing illustrations, the engineroom of the *Kalakala* is remarkably roomy and simplified. Short, direct connections to and from the scavenging air blower and exhaust manifold reduce the amount of piping to a minimum. In addition, all fuel, lubricating, cooling and control piping and wiring are placed under the floor plates out of sight.

In the process of converting this vessel to Diesel from steam and also through lighter weight super-structure it was possible to save slightly under a half a million pounds in weight despite the fact that she now has four decks instead of three and 3,000 hp. instead of 2,600. While most of this saving was absorbed by increased payload it was also possible to install exceptionally large fuel oil and fresh cooling water tanks which greatly increase the available period of uninterrupted operation. This feature is of prime importance when one considers the previously mentioned terrific schedule which the *Kalakala* is required to maintain. The acceptance of this craft by the traveling public has been phenomenal due in part naturally to her attractive interior appointments but of even greater importance is the assurance of her dependability.

California sheep and cattle truck and trailer powered with a Waukesha Comet Diesel for operation between the Sacramento and San Joaquin valleys and the San Francisco and Los Angeles markets.

DIESEL LIVESTOCK TRUCK

By MERTON HEALD

AN important new use of the Diesel motor in freight transportation has been developed by the Fageol Truck & Coach Company engineers in their new model, designed especially for moving sheep direct from the corral to the market.

The new unit, the largest motor type transport vehicle in use on California highways today, is designed to afford the maximum of space and weight capacity, carrying approximately one carload. Each part of the vehicle, which consists of a truck and trailer of equal capacity, has a gross vehicle weight of 34,000 pounds, thus achieving the maximum total permitted by California law, which is 68,000 pounds. The truck and trailer have a combined length of 60 feet and the unit is 96 inches in width, again the greatest allowed by California highway regulations.

A 140 hp. Waukesha Comet motor powers the new Fageol unit, which embodies full Diesel principles and achieves extremely low operating cost for a unit of its size and capacity.

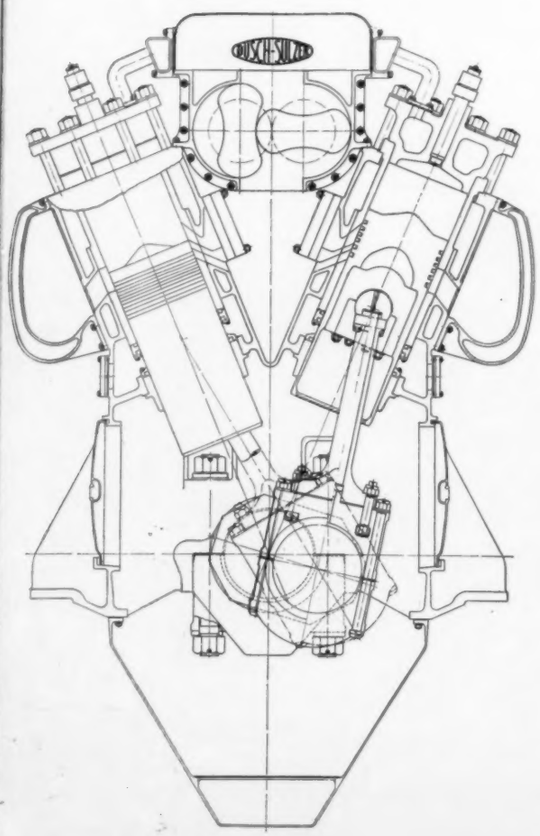
The all-steel cab is over the motor, permitting use of all available space for the load. It is equipped with air brakes. A special feature is the cushioned shelf provided in the cab so that the driver can sleep during the time for loading and unloading.

The advantages of this new model are economy and speed. The time required to transport sheep from corral to market has been reduced by about 24 hours through the elimination of time formerly consumed in transferring from the truck to cattle cars and back to trucks for delivery to the market. Sheep are now delivered in 11 or 12 hours from Stockton and San Joaquin Valley points to San Francisco or Los Angeles. An added advantage is the fact that the sheep are subject to less loss of weight in the shipping by fast motor transport and the stockmen realize more from their sale at the . . . . *And now please turn to page 59*

2000 H.P. ILLINOIS CENTRAL DIESEL LOCOMOTIVE

THE most powerful single-unit, Diesel-electric locomotive ever built in America is now in freight transfer service at the Chicago yards of the Illinois Central Railroad. It was built at the Erie, Pennsylvania, shops of the General Electric Company and powered by Busch-Sulzer.

The operating characteristics of this new unit are quite unusual. It has a top speed of 64 miles per hour and a maximum tractive effort rating of 100,000 pounds, which assures its ability to start and transfer a 6,000-ton train. The continuous tractive effort rating is 35,000 pounds at 16.5 miles per hour. The electrical transmission is so arranged that the full horsepower output of the Diesel engine can be utilized over a wide speed range of from zero to 46 miles per hour. With the controller handle in the high speed position before starting, the proper motor connections are made automatically with transitions at the correct speeds as the locomotive accelerates. This feature assures maximum performance and relieves the engineer of the necessity of excessive control manipulation.



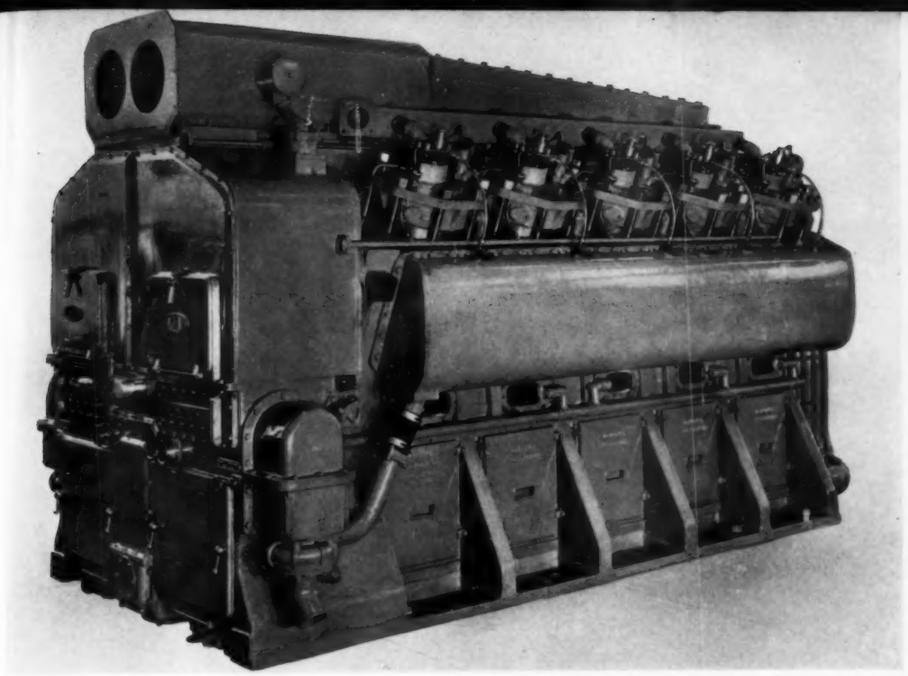
The heart of this "last word in freight shifters" is the 2,000 hp. Busch-Sulzer Diesel engine. To design and manufacture a satisfactory unit of this size involved pushing beyond the limits of past practice and accepted standards so, as a result, this engine represents a logical and progressive step in the application of the Diesel to railroad service. It is a V-type, ten cylinder, two cycle, single acting, solid injection unit operating at 550 rpm., with a 14-inch bore and 16-inch stroke. The 45 degree angle between the two banks of five cylinders each is utilized as the receiver for scavenging air, the gear-driven Roots blowers being placed across the top of the "V" and the blower housings acting as covers. The engine is amply protected by Cuno fuel and lubricating oil filters, Motometer thermometers and an Alnor prometer. Burgess mufflers are placed on the exhaust and air intake lines and assure quiet engine operation. Cooling is effected by means of Modine radiators.

Pistons are made of cast aluminum with the wristpin bearing in a separate housing which is inserted into the piston from below. Thus the piston skirt is not pierced by the wristpin. resulting in a construction which permits full freedom for expansion. Likewise, full expansion is provided for the upper and lower liners which form the working cylinders by fastening these liners only at their upper and lower flanges respectively. Both liners extend into a so-called "sludge chamber," there being a gap between the ends of the liners in each cylinder. By means of glass covers and electric lights, unobstructed inspection of the piston while running is possible through this gap. Briefly, this type of cylinder construction provides the following advantages over the conventional type:

No hot combustion gases or sparks can enter or heat up the crankcase. Obviously, lower crankcase temperatures tend to reduce the consumption of lubricating oil.

The action of the two sets of wiper rings which are located above and below the sludge chamber effectively prevents excessive quantities of lubricating oil from being carried from the crankcase into the cylinder by the piston skirt.

The engine frame is made of cast-iron and includes the crankcase with cross girders and bearing saddles, as well as the cylinder jackets for both banks of cylinders. The crankshaft is



of the "underslung" design supported in bearing caps bolted directly to the cross girders. The oil pan bolted under the engine frame acts as a collector for all lubricating oil draining from the various bearings. Since the scavenging oil pump continuously pumps out all oil that collects in the pan or trough, the engine operates with what is commonly called a "dry sump." All engine bearings, gears and control mechanism are pressure lubricated. As a safety measure the controls are so adjusted that the engine cannot be started with a lubricating oil pressure of less than 12 pounds per square inch. Likewise, if the engine is operating and the pressure in the lubricating system drops below the above figure for any reason, automatic shut-down occurs at once.

The Diesel is started by using the main generator as a starting motor and drawing current from the Exide storage batteries installed in the locomotive. Speed is regulated by a variable-speed governor which gives any desired speed between 275 rpm. for idling and 550 rpm. maximum. When starting, compression in the cylinders is relieved until the engine attains sufficient speed when the compression-relief gear is cut out and fuel supplied to the cylinders.

As the service for which this particular locomotive is intended demands a high starting tractive effort, it was determined that an engine weight of 36 pounds per brake horsepower could be employed to advantage. The same engine can be built with a weight of as low as 23 pounds per horsepower if service conditions should require.

By taking advantage of the maximum bridge loading permitted by the railroad, it was possible to limit the number of axles to six and thereby design a simple running gear, consisting of two three-axle, non-articulated swivel trucks upon which the cab is mounted. On each axle is mounted a 360 horsepower motor with maximum reduction gear so that the six driving motors have ample capacity for the work involved. The traction motor control is handled with standard electro-pneumatic contactors and reverses and gives the following combinations in the order named:

1. Two motors in series, three groups in parallel, full field.
2. Two motors in series, three groups in parallel, shunted field.
3. Six motors in parallel, full field.
4. Six motors in parallel, shunted field.

The desirable feature of constant engine horsepower is maintained over a wide range of speed (0 to 46 mph.) by a combined exciter and pilot generator belted to the shaft of the main unit and mounted above the auxiliary generator. The pilot generator is extremely sensitive to speed changes and through a winding on the exciter magnetizes or demagnetizes the exciter field as required to main the correct Diesel engine speed.

The equipment layout is characterized by accessibility and ease of maintenance. The Diesel-generating set obviously occupies the greater portion of the central compartment with control and air-brake equipment, engine auxiliaries and traction motor blower sets disposed of at each end.

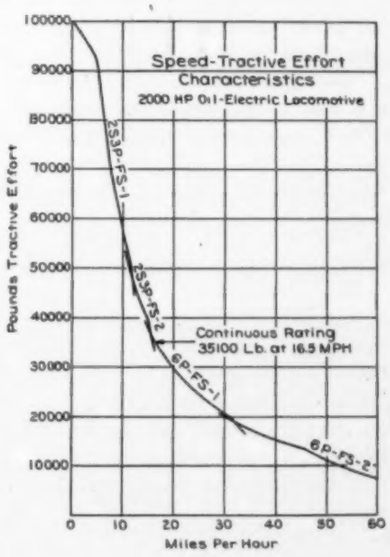
Three hatches are provided for removing heavy parts from the engine, generator or other machinery. The top of the Diesel is readily accessible for cylinder-head or piston removal by simply lifting the main hatch cover. Fuel pumps, governor, and similar incidental engine equipment are located at the free end of the unit and can easily be reached from the aisle by removing the proper covers on the end housing. Almost all piping is carried underneath the false floor and valves, if covered, are reached through trap doors.

A lubricating oil tank is located at each end of the locomotive in the radiator compartments. The 1,200-gallon fuel tank is of welded construction and is suspended from the cab underframe. This arrangement, as contrasted with a built-in tank, integral with the frame structure, avoids the possibility of leakage due to deflection and weaving.

In summation, the following major objectives were sought in the design and manufacture of this newest type Diesel-electric locomotive:

1. Simple, rugged construction throughout for long life, reliable operation and high availability.
2. An accessible equipment layout for low maintenance cost.
3. Ample tractive effort capacity, full engine utilization over an adequate speed range for transfer service and high maximum speed to assure satisfactory performance under all conditions of service.

It is believed by all concerned that these objectives have been reached and satisfactory operation is being watched with keen interest by many segments of the railroad world.



The Cooper-Bessemer Diesel Ferry "City of Burlington" on regularly scheduled run between Burlington, Vt. and Port Douglas, N. Y.

CITY OF BURLINGTON

WITH the debut of Lake Champlain's new streamlined, Diesel ferry, *City of Burlington*, a highly valuable and convenient service has been made available to motorists touring the popular vacation land of the Adirondack Range and the beautiful Green Mountain country. This remarkable vessel is the first of two which will operate between Burlington, Vt., and Port Douglas, N. Y. Tourist traffic at this point on the lake is exceptionally heavy due to the popularity of Ausable Chasm near Port Douglas.

Mr. Horace W. Corbin, President of the Green Mountain Adirondack Ferry and Drydock Company, is personally responsible for the new Diesel ferry and her sister ship which will be added to the service as soon as completed. He is to be congratulated upon the very successful operation of his new boat to date although this was practically assured due to the unusual research and preliminary study which preceded his selection of design and equipment. After the size and general lines were decided upon Mr. Corbin in conjunction with the Maierform Corporation of America referred the problem to the Hamburg, Germany, Experimental Basin where a towing model was built and tested to determine hull and machinery characteristics. While such a procedure was fairly expensive both as to time and money, it is generally believed that the results obtained will amply justify the cost due to the frequent severe squall conditions peculiar to the Lake Champlain waters which have presented quite a problem in operating previous boats of this type.

The following advantages of Maierform hull construction over normal form were well proven by the model tests:

Less resistance in smooth or disturbed water.
Better seaworthiness.
Increased maneuverability.
Greater stability.
Wider decks.
Smaller wetted surface (less plating).

Accordingly, this type of hull design was adopted and the final general dimensions are as follows:

Length o.a.	153 feet
Length b.p.	140 "
Beam molded	40 "
Draft	6 ft. 6 in.
Depth	12 feet
Displacement	367 long tons

The Hamburg model tank tests also showed how much power was required for the desired service speeds and a graph was plotted to indicate power throughout the speed range. The engine selected by Mr. Corbin was a Cooper-Bessemer type JT eight-cylinder Diesel.

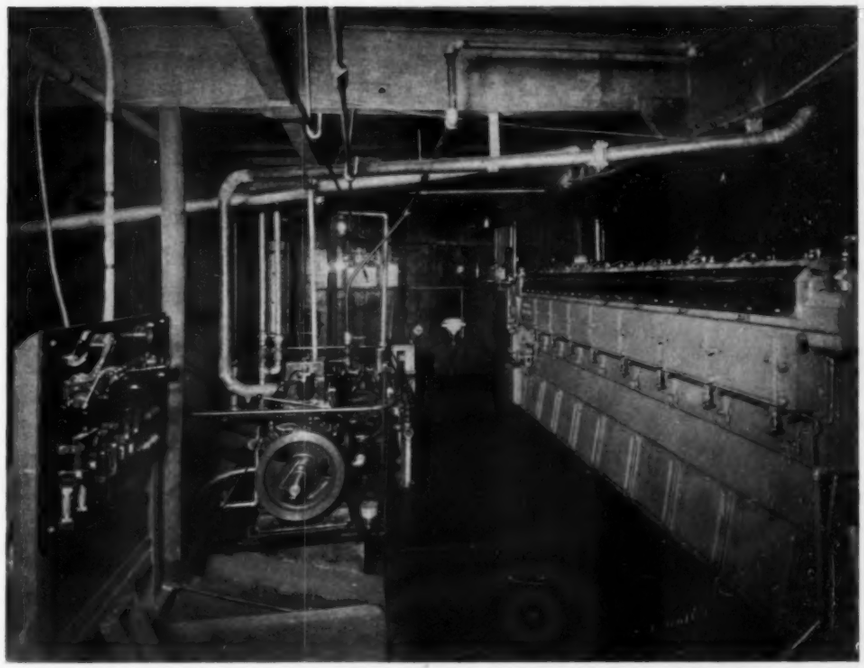
The power cylinders have an 11½-inch bore and a 15-inch stroke and carry cast iron pistons. This unit develops 450 hp. at 360 rpm. and is directly connected to fore and aft propellers, one pulling and one pushing regardless of which direction the vessel is operating in its

double-ended service. To accomplish the above connection it was necessary to utilize 85 feet of intermediate shafting between the two propeller shafts. While this arrangement simplified the power design to a great extent it presented a system which was wide open to the possibilities of critical vibration. To the engine builder goes the credit, therefore, for the entirely smooth delivery of power from the very first trial trip. The main engine is equipped with a Sentinel fuel oil filter, a Reliance tachometer and a Brown pyrometer. An electric alarm bell controlled from the lubricating oil pressure gauge gives loud and insistent warning should the line pressure drop to a point dangerous to operation. A small instrument of great importance is the cam shaft indicator mounted directly on the Diesel. It informs the engineer at a glance the direction of rotation of the engine and, hence, the direction in which the ferry will move when power is applied. This is a relatively small feature but it saves many embarrassing if not dangerous situations.

The auxiliary engine is a Lister Diesel of 7 hp. connected to a 3 kw. generator. This engine also drives through V-belts a two-stage starting air compressor and a Gould's bilge and fire pump. Two Maxim silencers insure exhaust muffling of both main and auxiliary Diesels.

The *City of Burlington* has an all-welded hull provided with six watertight bulkheads and bilge suctions in each compartment. It was fabricated by the General Ship and Engine Works in East Boston and shipped to the shore of Lake Champlain near Burlington for assembly. It is understood that Mr. Corbin intends to completely fabricate and assemble the second ferry at Burlington. He has already placed his order for another Cooper-Bessemer Diesel for this vessel which will undoubtedly be named the *City of Keeseville*. In connection with hull construction it is interesting to note that the deck plating is of one inch thickness and reinforced by extra-heavy and closely spaced carlins. While the usual service will constitute the transportation of motor cars this added deck strength will accommodate army field artillery pieces engaged in maneuvers at and about the Plattsburg training post.

The launching of this new Diesel "streamliner" took place on July 2, 1936, and active service was inaugurated about three weeks later. The distance between Burlington and Port Douglass is about nine and a half statute miles and to date the trip has averaged thirty-seven minutes. On this basis the speed comes



Engine room of the "City of Burlington" showing the 450 hp. Cooper-Bessemer main Diesel and the Lister auxiliary generating set.

to approximately 15 mph. or 13 knots. The original plan involving these two ferries was predicated upon a regular half hour schedule from each end and when the second boat enters service this should be attained.

Due to climatic conditions the operating season on Lake Champlain is limited to five spring and summer months beginning on May first and ending on October first when the ice begins to threaten navigation. During the winter the ferries are hauled onto the shore. From May on, however, a continuous twelve-hour service is maintained daily with the first boat leaving Burlington at 7:00 A.M. Eastern Standard Time. The importance of this run is evident when the following route connections are considered:

In New York – connecting via Port Douglass on Routes No. 9 and No. 22 for Albany, New York City and Montreal.

In Vermont – connecting at Burlington on Routes No. 2, No. 7 and No. 15 to all New England points.

The net results of this latest addition to the inland water-way Diesel fleet is, as usual, better service to the public and greater profits to the owner.

April 30, 1936, saw the main engine going in through the side. One of the high-lights of assembly after prefabrication of the vessel in East Boston.

Houma, 80-foot towboat, the fourth Winton-powered boat placed in service by the Texas Co. Equipped with a 430 h.p. engine at 275 r.p.m.

The *Coiner*. Owned by U. S. Engineers. Built by the Marietta Manufacturing Company. Overall length 177 feet, 3¼ inches. Powered with two Winton-Diesel engines each developing 650 h.p. at 250 r.p.m.

The *George Levingston*, length 65 feet, 9 inches. Owned by Wm. T. Burton and powered with a 350 h.p. Winton-Diesel engine

Turecamo Boys, second Winton-Diesel towboat to be launched by the Turecamo Contracting Co. This 93-foot boat is powered with a 600 h.p. engine at 250 r.p.m.

WINTON ENGINE CO
CLEVELAND, OHIO

Advanced-type

WINTON DIESEL ENGINES

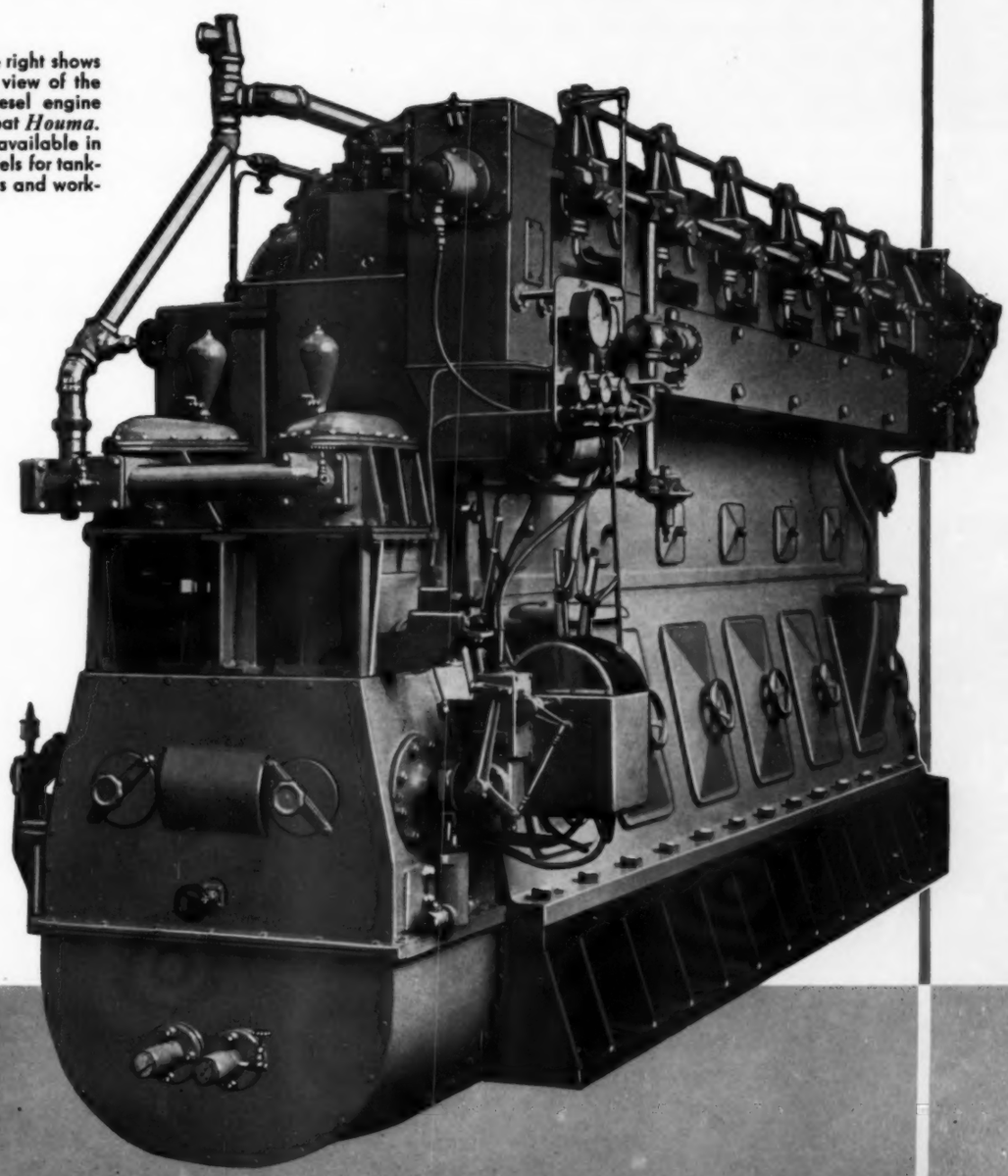
Prove their Economy in Workboat Service

★

Winton-Diesel engines are powering the workboats of many of the largest and most prominent firms operating in the commercial field. These rugged, compact units have, for years, enjoyed an outstanding reputation for their thoroughly dependable performance and economical operation.

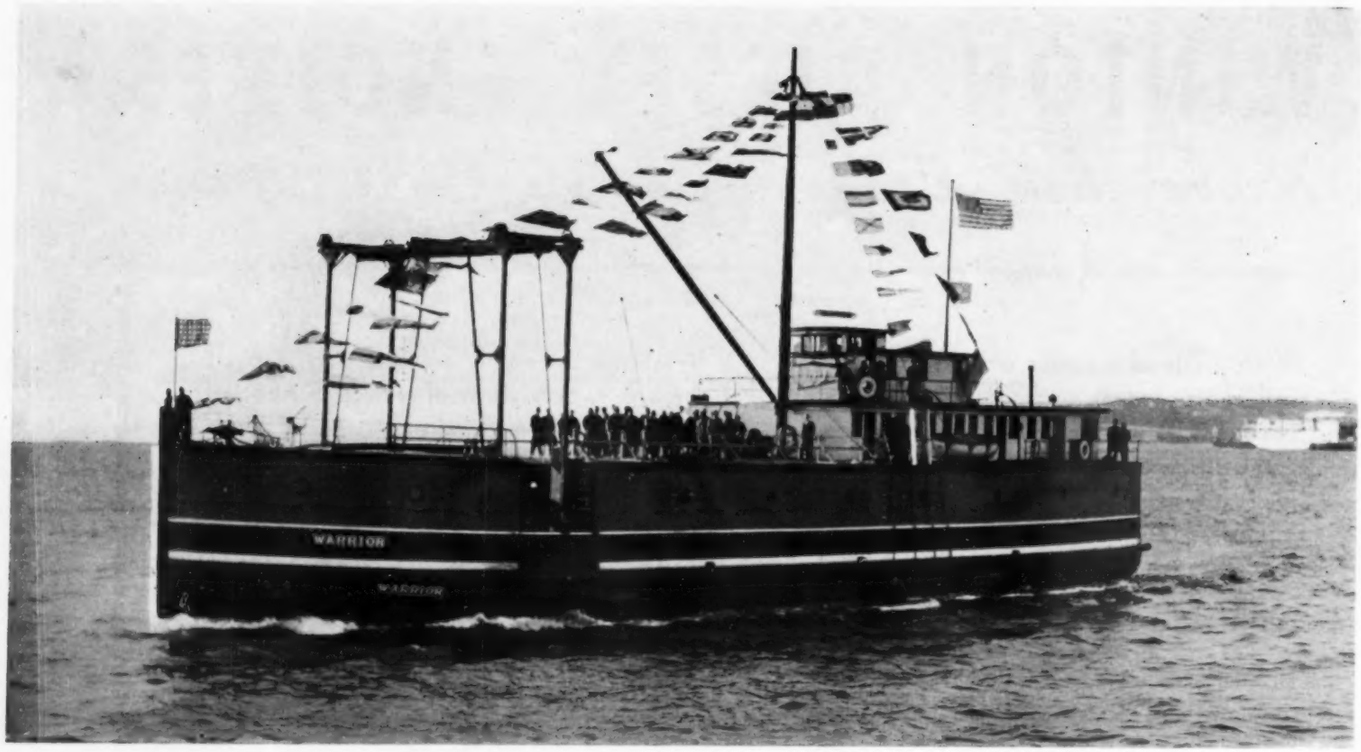
Winton economy is real economy, proved through twenty years of service in meeting diversified power requirements in all kinds of workboats. We suggest that you investigate their possibilities as the solution to your perplexing power problems, whether it involves new or replacement installations.

The illustration to the right shows a three-quarter front view of the 430 h.p. Winton-Diesel engine installed in the towboat *Houma*. Winton engines are available in a wide range of models for tankers, towboats, dredges and workboats of all types



Symbol of Economy and Dependability

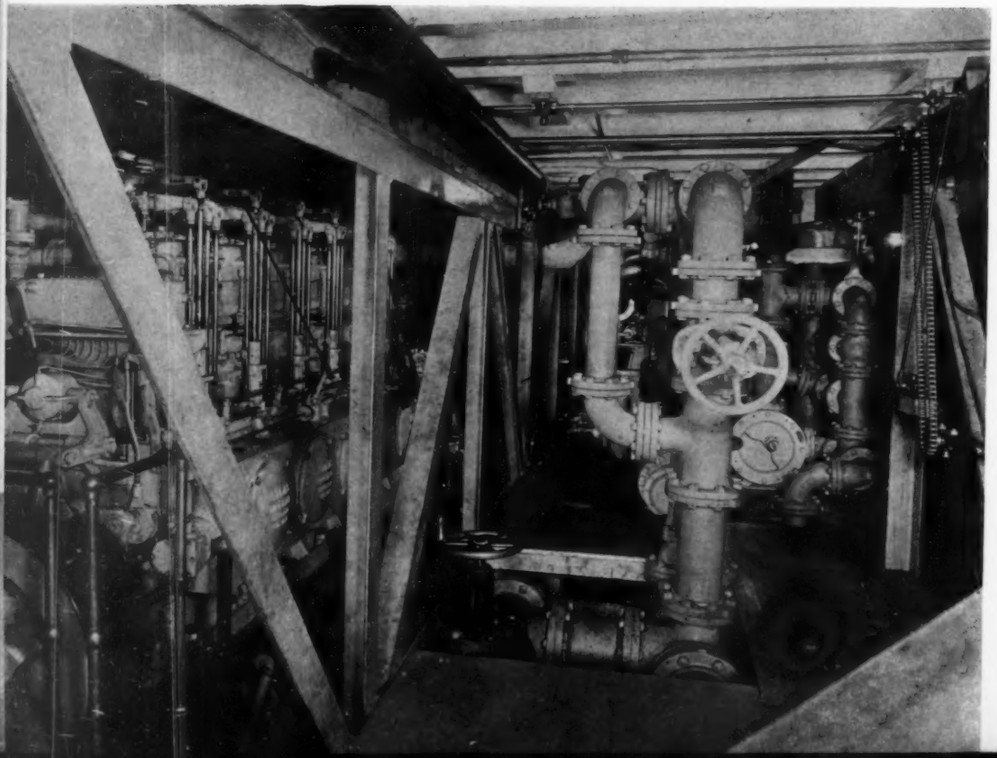
NE CORPORATION
OHIO, U. S. A.



M.S. "Warrior" undergoing successful trials. Note extreme height of steel platform cargo elevator and upper fore-deck freight space.

DIESEL FREIGHTER WARRIOR

By CHARLES F. A. MANN



Cargo-oil header system between the two Atlas Diesels driving the new M.S. "Warrior."

OPERATING one of the busiest local marine freight lines in the United States, the Puget Sound Freight Lines of Seattle have just completed their largest shallow-draft Diesel freighter, the M.S. *Warrior,* a 154-footer of unique layout.

Considerable has been published in marine journals about this type of craft, on a purely maritime basis, but the economic reason for these unusual vessels has received little attention. Throughout the United States there is a constantly growing volume of local freight that moves on inland and river waters much in the same manner as freight hauled by trucks

or railroads. On Puget Sound, where paved highways parallel water routes on both shores and fast cross-sound ferry service bridges the 200-mile waterway with frequent service, water carriers face stiff competition, and in order to operate at all must carry cargo at extremely low rates. Because of the eleven to fifteen foot tidal range, and the diversity of ports, some on open and very deep bays, while others on river-like, very shallow inlets, and the peculiarities of the two-way cargo movement throughout most of the area, gave rise shortly after the World War to a brand new type of American vessel. F. H. Marvin of Tacoma, founder of the Merchants Transportation, predecessor of the Puget Sound Freight Lines, saw in the novel Diesel engine of that period a chance to junk the traditional Sound-type (modified Great Lakes type) steamer, with its awkward method of trucking freight up an inclined plane through side-ports, assisted by a cable and steam winch, the outer end hooked to a pulley on the dock – and substitute a very beamy, flat-bottomed craft powered with compact Diesels of about the size used in fishing vessels. By substituting a steel platform elevator on the bow that would raise cargo as much as thirty feet, vertical lift, cargo could be rapidly handled in parcels to any out-of-the-way port and at any stage of the tide.

So successful were Mr. Marvin's original ideas that this basic design eventually ran every steam freighter off Puget Sound and it was adopted on San Francisco Bay for the up-river runs, these vessels eventually causing a fleet of twenty steamers to tie up completely. Later a modification of this design was taken up on Atlantic and inland river runs. Plans are completed for steel vessels of this type for the Columbia River.

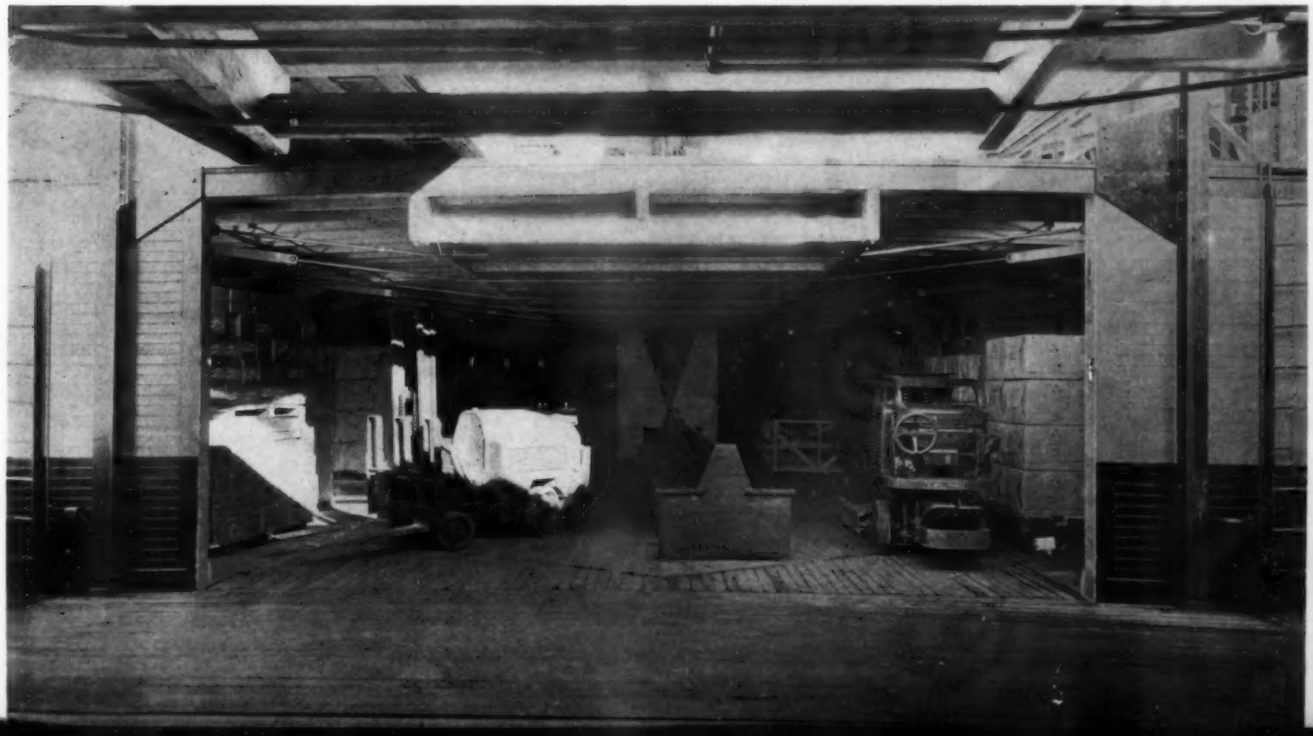
The peculiar feature of these queer-looking craft is the fact that it is DIESEL PROPULSION OR NONE. Rather startling, but very true, for space limitations in the flat, barge-like hull would not permit steam power of any kind, even if it were possible to operate the plant as cheaply as Diesel. Gasoline engines are taboo because of fire hazard aboard wooden craft. By holding the speed of these craft down, it is possible to move 300-400 tons of freight with as little as 200 horsepower and still keep most of the runs on an overnight basis from principal ports. With a draft not to exceed seven feet, loaded, this type of craft can be constructed almost as cheaply as a wooden barge, yet have a staunch hull needing few repairs and good for twenty years or more of service. As far as space occupied, the Diesel power plant in its eight foot headroom space below the freight deck occupies a minor part of the hull.

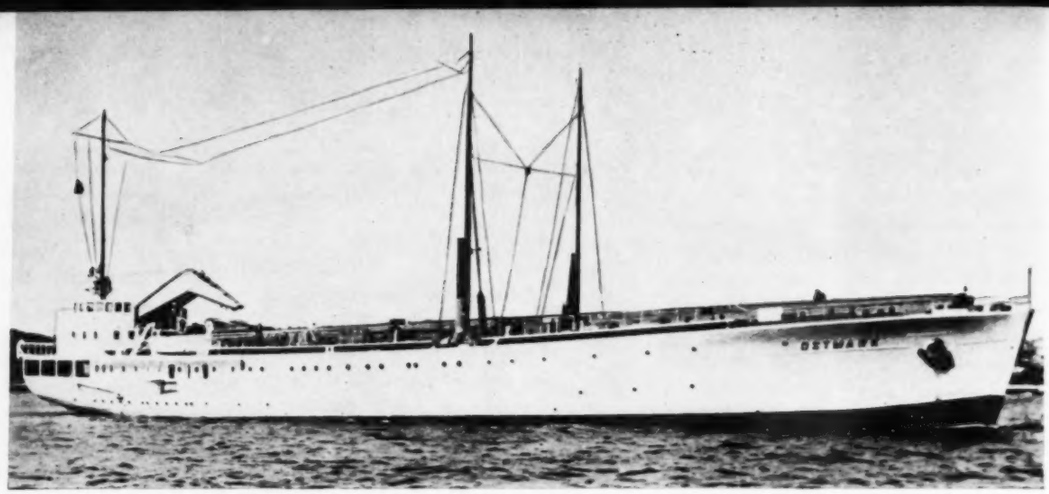
The entire network of the Puget Sound Freight Lines system is coordinated with truck-delivery and pick-up service at all principal ports. These little vessels, about ten in number, run on a time-table basis and are regular marine truckers, hauling everything from baled pulp and fuel oil to canned peas and dry goods, depending on which port they stop at. In addition assembly of large tonnage at central piers for reshipment aboard ocean liners, is an important source of revenue. She also carries large cargo oil tanks in her broad, shallow hull. A combination tanker-freighter of unique planning.

Latest of this fleet is the *Warrior*, an enlarged version of her dinstiguished but queer looking predecessors. She is 154 x 38 x 6½ feet draft loaded (three feet light) and constructed entirely of Douglas fir, with exception of five longitudinal bridge trusses under the freight deck to stiffen the hull and reduce weight. These are of pre-fabricated steel and run the entire length of the ship. She was largely designed by Howard Lovejoy, son of Capt. F. E. Lovejoy, president of the company, and was built at the plant of Western Boatbuilding Company at Tacoma. The use of five steel trusses makes an extraordinarily stiff hull, reducing the space below decks that would be required if wooden trusses were used.

The ship has no keel and three streamlined, hollow rudders, filled with pitch and cork to reduce weight. Forward in the hull is the chain locker followed by two 4 x 10 ft. compressed air tanks, operating at 100 lbs. per square inch to feed air to the conventional steam-type windlass, elevator hoist and winches. She carries an American Hoist Co. 8½ x 10 inch two-cylinder deck winch, an Allan Cunningham anchor winch driven by a four-cylinder rotary motor. The novel use of compressed air in place of steam, permits the easy handling of deck machinery with none of the disadvantages of steam power. Located just enough back of the bow to be in the wide part of the hull is the freight elevator platform, of 10 x 30 ft. in size, with a vertical lift of 30 feet with 4,600 lbs. of cargo. This is of all steel construction, and a telescoping I-beam traveling hoist that extends ten feet beyond the edge of the ship, is provided to swing the reinforced steel cargo plank, ashore and "spot" it . . . . *And now please turn to page 56*

Freight deck partly loaded with baled pulp and canned goods.





The "Ostmark," Deutsche Lufthansa's new airplane catapult ship and below a Dornier "Do 18" flying boat after being catapulted from the "Ostmark."

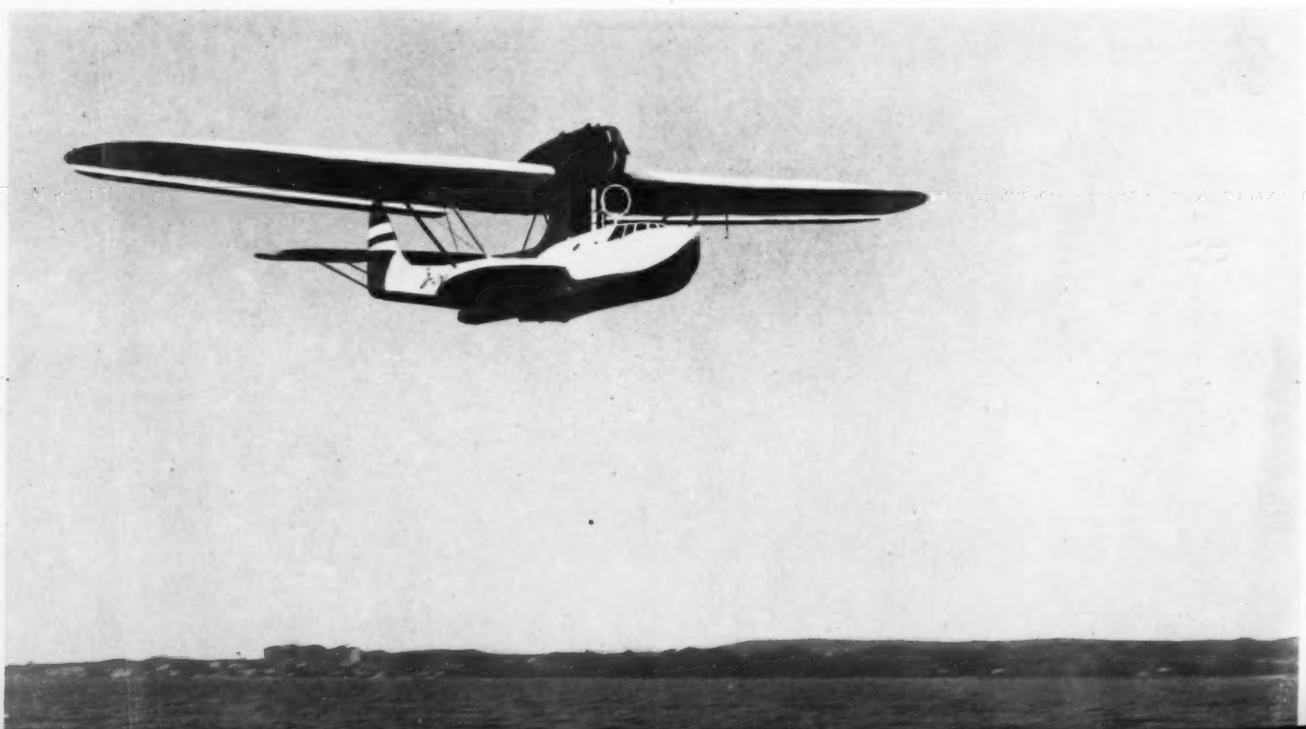
DEUTSCHE LUFTHANSA AIRLINE

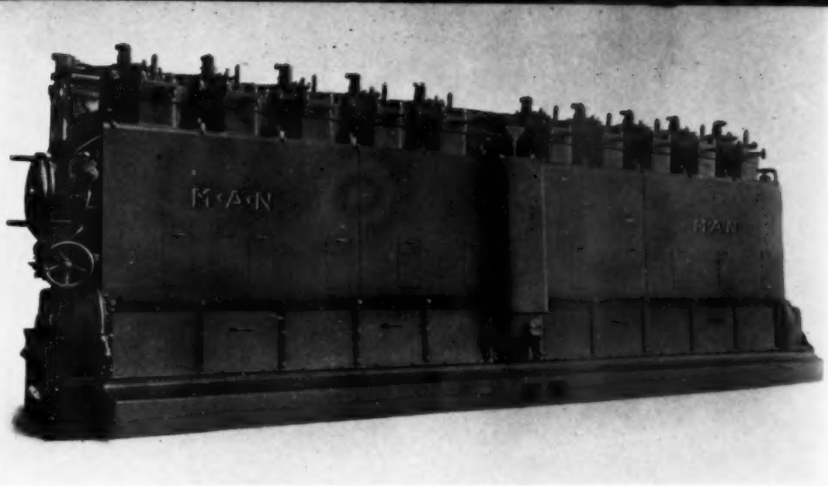
By PAUL H. WILKINSON

FOR the past two and a half years, Deutsche Lufthansa has successfully operated a bi-weekly airmail service from Germany to South America. The time required for this long trip of 9,500 miles, from Berlin to Santiago, in Chile, is five days. Originally the equipment consisted of bi-motored Dornier *Wal* flying boats and tri-motored Junkers *Ju 52/3m* landplanes and seaplanes. To assist in the 1,900-mile flight across the South Atlantic, two cargo ships—the *Westfalen* and the *Schwabenland*—were converted into catapult ships and stationed near each end of the crossing. By using the catapults on these "mother ships," the flying boats can begin their flight with maximum load without having to risk a take-off from rough seas.

After the development of the Diesel engine in Germany and its economical application to aircraft, the original Dornier *Wal* flying boats were replaced by the latest model, the Dornier *Do 18* with two Junkers *Jumo 205-C* Diesel engines. This plane was described in the June issue of DIESEL PROGRESS, and it is therefore unnecessary to elaborate on it again except to say that it has proved extremely satisfactory for this work.

One of the original catapult ships, the *Schwabenland,* was equipped with Diesel engines, which permitted the same type of non-inflammable fuel to be used for both ship and planes. Deutsche Lufthansa has decided to use a similar system for its North Atlantic route which will soon be in operation, with





catapult ships stationed near the Azores and near Bermuda.

To accomplish this plan, the *Schwabenland* is to be transferred to the North Atlantic and a larger ship is being built as its team mate. These catapult ships will handle the Dornier *Do 18* flying boats with which the service will be started. For the South Atlantic, a new Diesel-engined catapult ship, the *Ostmark*, has just been completed to take its place with the *Westfalen*.

The *Ostmark* is a 2,200-ton ship, built by Howaldtswerke A.G. of Kiel. It represents the latest design in catapult ships and although it is smaller than its predecessors, it has relatively more space as it was designed for its particular purpose. Its length is 246 ft., its beam is 37 ft., and it has a speed of 14 knots.

The two M.A.N. engines used for propulsion are of single-acting, two-stroke design, type GZ, which has proved very satisfactory for both main and auxiliary use. The type number, G 10 Z30/42, indicates that it is a ten-cylinder engine having a bore and stroke of 11.8 ins. (300 mm) and 16.5 ins. (420 mm) respectively. The total displacement is 18,100 cu. ins.

These engines develop 900 hp. at 310 rpm., and 1,000 hp. at 350 rpm. They are directly reversible. The pistons are oil-cooled, and the thrust block for the propeller shaft is embodied in the baseplate. Air for the M.A.N. loop scavenging system is supplied by a positive type gear-driven blower on the exhaust side of the engine. It is started by compressed air at a pressure of 440 lbs. per sq. in.

The catapult equipment was built by Heinkel and weighs 103 tons. Its overall length is 136 ft. 1½ ins., of which 103 ft. 8 ins. is available for runway. The cradle for the hull of the flying boat is 18 ft. 10 ins. long, and the rails on which it runs are 7 ft. 3 ins. apart. This type of catapult can handle aircraft up to 16.5 tons gross weight. Air compressed to a pressure of 2,350 lbs. per sq. in. is used to give an acceleration of 3.5 g (112 ft. per sec.) to the plane which, at the end of the runway, attains a speed of 87 mph. – considerably in excess of the speed required for flight.

To hoist the flying boats from the water, an electric crane built by Kampnagel has been installed. It is equipped with a powerful searchlight, and can be folded down on deck in rough weather. A "towing sail" is attached to the stern of the *Ostmark* and floats on the water. This creates a smooth "wake" behind the ship when the latter is in motion on which the flying boat can land before being hoisted on board.

Every comfort has been provided for the crew of the *Ostmark*, including a movie theater with sound equipment. Powerful radio sending and receiving sets enable the ship to be in constant communication with land stations and with the flying boats, and a directional beam is also used to guide them. One end of the aerial is attached to the rear mast, and the other end to one of the masts amidships which are lowered outward when the plane is ready to be catapulted. There is ample tankage for the planes, with the advantage that there is no loss of valuable fuel through evaporation.

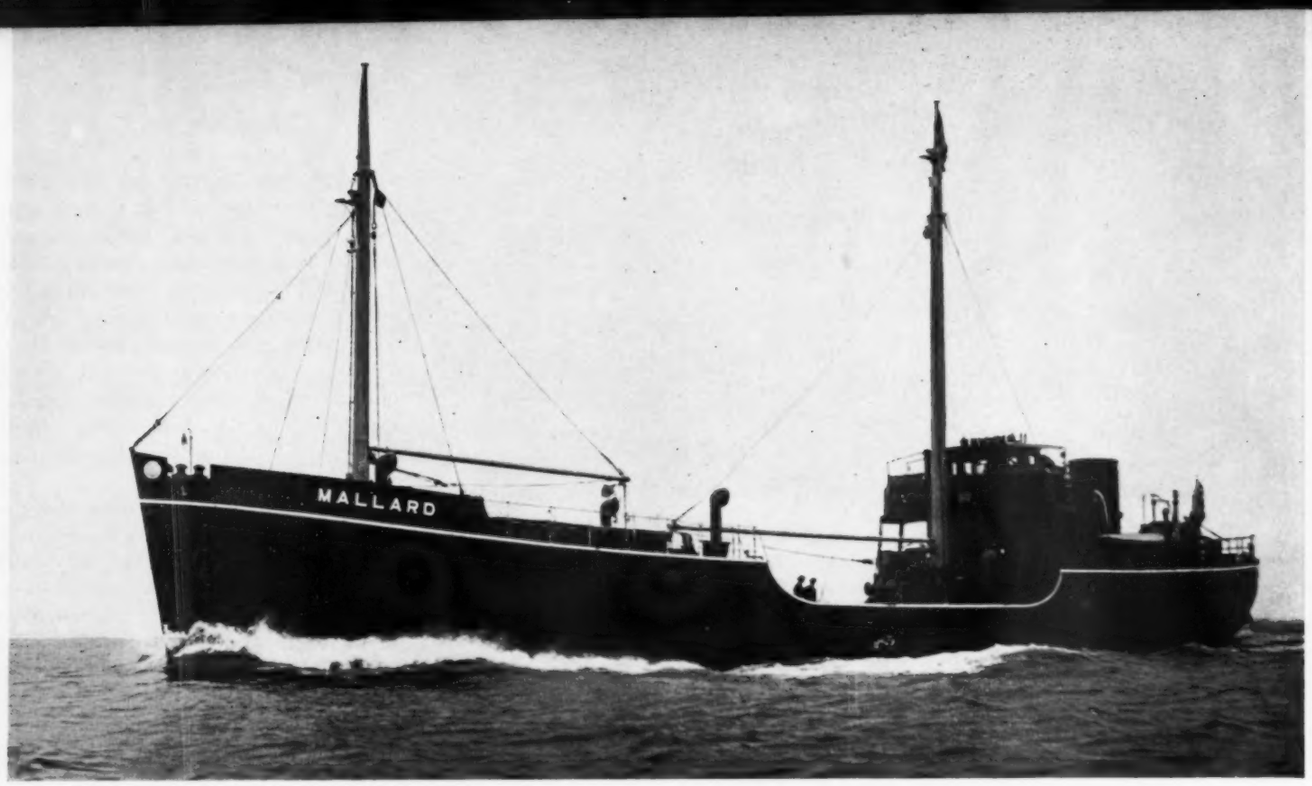
Here we have an ideal combination of equipment provided by a progressive European airline – a Diesel-engined "mother ship" and Diesel-engined planes – which simplifies operations and greatly reduces costs. The operations in the North Atlantic will now be awaited with interest.

COL. CHARLES A. LINDBERGH

It is interesting to note that Col. Lindbergh, during his recent visit, expressed considerable surprise at the thorough development of the Diesel engine for aircraft in Germany. He admitted that in this field, Germany leads the world and that we, in America, are far behind.

These comments by one of our foremost figures in aviation should make interesting reading for our airline operators and government officials!

Map of the Deutsche Lufthansa airline system from Germany to South America and above, one of the two 900 hp. M.A.N. Diesel engines, type GZ, installed in the "Ostmark."



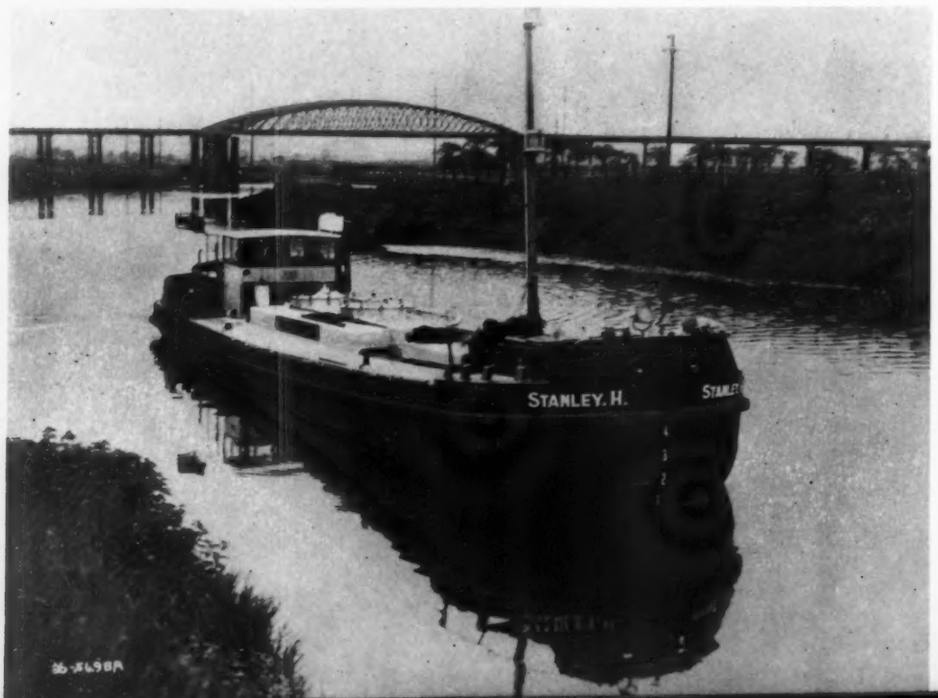
Motor Coaster "Mallard" on sea trials. Main engine: 500 bhp. two-cycle Polar Diesel

LONDON LETTER No. 10

By GEORGE LIND

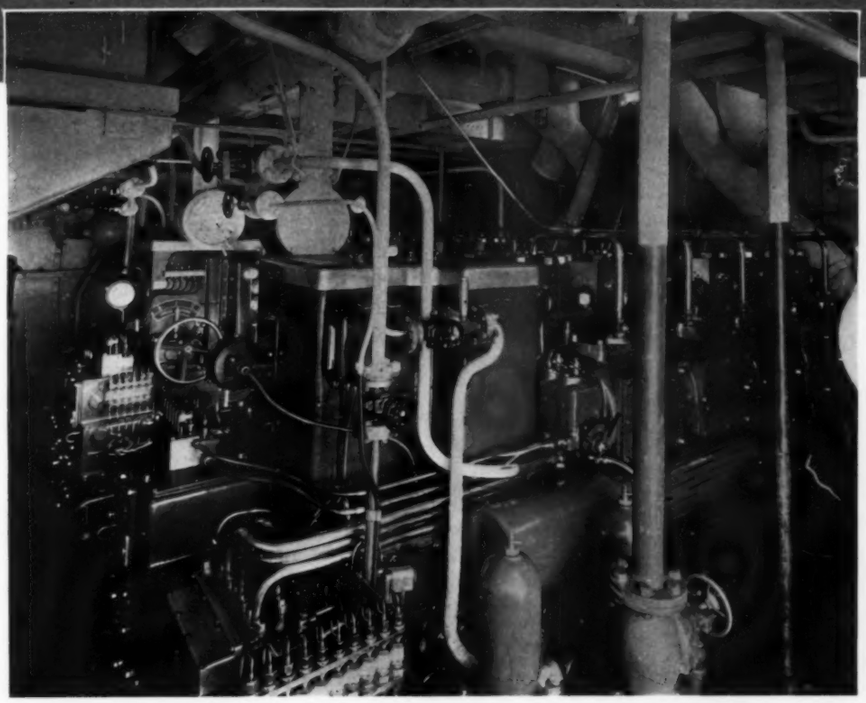
OF the many classes of shipping sailing the seas today, none offers greater scope for Diesel propulsion than the small cargo coaster. At present there are more than 700 steam-driven coasters and 57 motor vessels of between 300 and 1,500 tons plying around our shores, yet of the former about one-half are obsolete and ready for scrapping. Wide-awake Diesel engine manufacturers have already tapped this wonderful new market and are reaping a valuable harvest in replacement orders. Nevertheless, there is still plenty of room left for other firms to step in, provided they can supply a really reliable engine at the right price.

To give some idea of the type of machinery required here, then, is a description of the General Steam Navigation Company's latest motor coaster *Mallard*, built by the old Scottish firm of shipbuilders, the Caledon Shipbuilding and Engineering Co., Ltd., of Dundee. She is 160 feet in length, has a semi-balanced streamlined rudder, a cruiser stern and raked stem and can carry a maximum load of 490 tons. The main engine is a four-cylinder, two-stroke Polar Diesel, developing 500 bhp. at 220 rpm., and is provided with a direct coupled scavenging air pump. A feature of the ship's equipment is the exclusive use of electricity for all auxiliary work, the air compressor, water circulation pump, centrifugal purifiers, winches, etc., all being driven from two 37 bhp. three-cylinder Allen 24 kw. generating sets. On her maiden voyage from Dundee to Rochester, when the fuel consumption worked out at 2 tons, 1 cwt. per 24 hours, no attempt was made to run the main engine at full speed, 9.3 knots being reached with the motor at a steady 200 rpm. Later, during the trials on the measured mile



Diesel canal tanker "Stanley H." on the Manchester Ship Canal.

M.V. "St. Silio," North Wales passenger motorship. A total of 600 bhp. is supplied by two Crossley six-cylinder Diesels.



with 250 tons of ballast aboard, the speed for the double run was over 11.4 knots. The normal service speed will be 11 knots.

The *Mallard* is but one of a class. She represents the coaster at its best — clean, businesslike, reliable and, above all, cheap to operate. With a steam engine in place of the Diesel she might still be clean and businesslike, but her fuel bill would be at least twice as heavy.

Although hardly in the same category as motor coasters, the recently completed 50-ton canal tanker *Stanley H.* and the Scottish Fishery Board's new patrol boat *Fidra* are no less interesting, since they, too, are representative of types of craft for which Diesels are becoming increasingly popular.

The *Stanley H.* is a fine example of modern barge construction and is used for transporting spirit on the Manchester Ship Canal. She is built of steel and is 73 feet long with a 14-ft. beam. The engine is a 70 bhp. four-cylinder four-stroke Ruston unit, developing its rated power at 1,000 rpm. The maximum speed through the water is 7½ knots. Ruston engines, incidentally, are now very much favored for this type of installation, their straightforward design and reliability being appreciated

Scottish Fishery Board's Diesel patrol boat "Fidra" with two Gleniffer engines installed.

far more by critical barge owners than promises of spectacular performance.

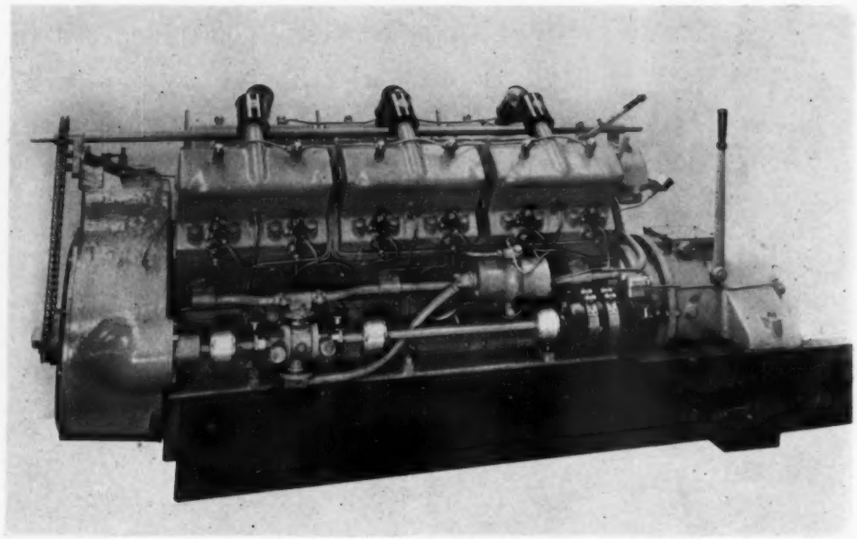
The *Fidra*, built at the yards of James N. Miller & Sons, of St. Monance, Fife, appears outwardly quite an ordinary fishing trawler, although in point of fact she is nothing of the kind. Intended for patrolling the coast of Scotland to enforce the fishing regulations, she is 56 ft. in length and is powered with two 120 bhp. six-cylinder Gleniffer Diesels, which should give her a speed of 12 or 13 knots. Her accommodation includes three officers' cabins aft and an officers' dining saloon. The engine room is located amidships and, in addition to the main engine, contains a small electric lighting plant. Other equipment includes a Siemens wireless telephony set, and especially large fuel tanks to allow a wide range of action.

Among recently completed smaller types of passenger vessels one particularly outstanding example is the Liverpool and North Wales Steamship Company's new boat, the *St. Silio*. This vessel has the distinction of being the largest, most powerful and most luxurious British Diesel-driven ship intended entirely for summer passenger and tourist traffic. She will operate in conjunction with two well-known steamships from Liverpool in the North Wales trade, and has been constructed on the Clyde by the Fairfield Shipbuilding & Engineering Co., Ltd., well known as specialists in high class shipbuilding. Her dimensions are overall length 150 ft. b.p. with a molded beam of 27 ft., and she can carry a complement of 600 passengers at up to 12 knots. Two Crossley six-cylinder 300 bhp. engines provide the necessary propelling power, both being of the two-stroke, single-acting pump scavenging type.

The Crossley Scavenge Pump engine is one of the neatest and best finished jobs on the British market, and has been applied in various sizes to a wide and interesting range of ship types during the last three or four years. These include coasters, tankers, small coastwise passenger vessels, fenies, drifters and trawlers. The engine's salient features are:

- Built-in scavenge pump
- Direct reversing
- Monoblock type main frame securely bolted to base and forming one complete and rigid structure
- Great accessibility, made possible by a special system of easily removable inspection doors.

In recent years, orders for high speed marine Diesels of over 150 bhp. have nearly all been snapped up by Continental manufacturers



V-12 Ailsa Craig Diesel with reduction gear. This unit is rated at 144 bhp.

owing to the inability of home products to meet the need of the times. Now, at last, we have in this country two outstanding examples with which to bridge the gap, one built by Ailsa Craig, of London, and the other, fittingly enough, by Gleniffers, of Glasgow.

The Ailsa Craig engine is a 12-cylinder unit with the bores arranged in V formation at an angle of 70 degrees. The cylinder blocks and crankcase are cast integrally, the heads being mounted in pairs. A conventional type of overhead valve gear is used, incorporating push-rod operated valves actuated from a single camshaft located between the two banks of cylinders, and supported in seven bearings. The fuel pumps are also mounted between the cylinder blocks and deliver fuel to pintle type injectors which spray into combustion chambers of patented Acro design. At full load the fuel consumption is stated to be less than .45 lbs. per bhp. hour.

The bore and stroke of the engine are 4⅛ and 5½ ins., respectively, the power output at 1,500 rpm. being 144 bhp. The unit has an overall length of 8 ft. 8⅛ ins. including reduction gear, or 7 ft. 8⅞ ins. without, and costs between $4,500 and $4,800, according to the equipment specified. The accompanying illustration gives an excellent idea of the compactness of the whole unit and serves to show what British engineers can produce when they really care to get down to it.

The Gleniffer engine is also a V-type job, and is unique in that it is the first 16-cylinder high

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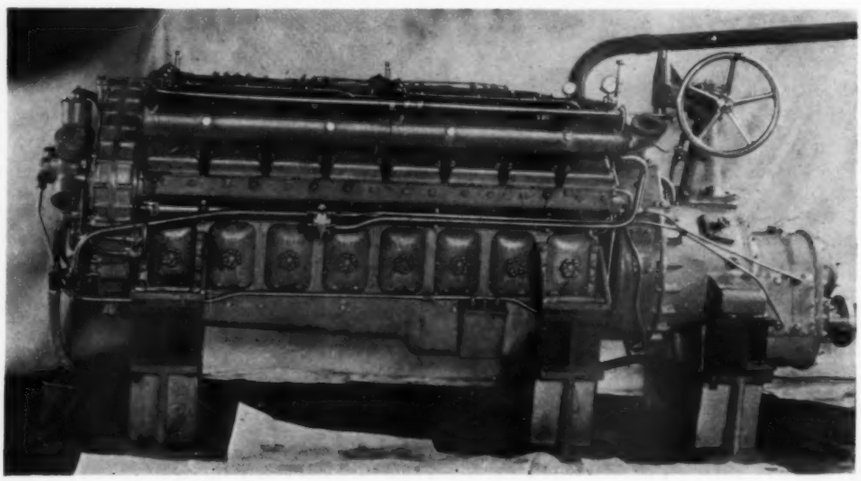
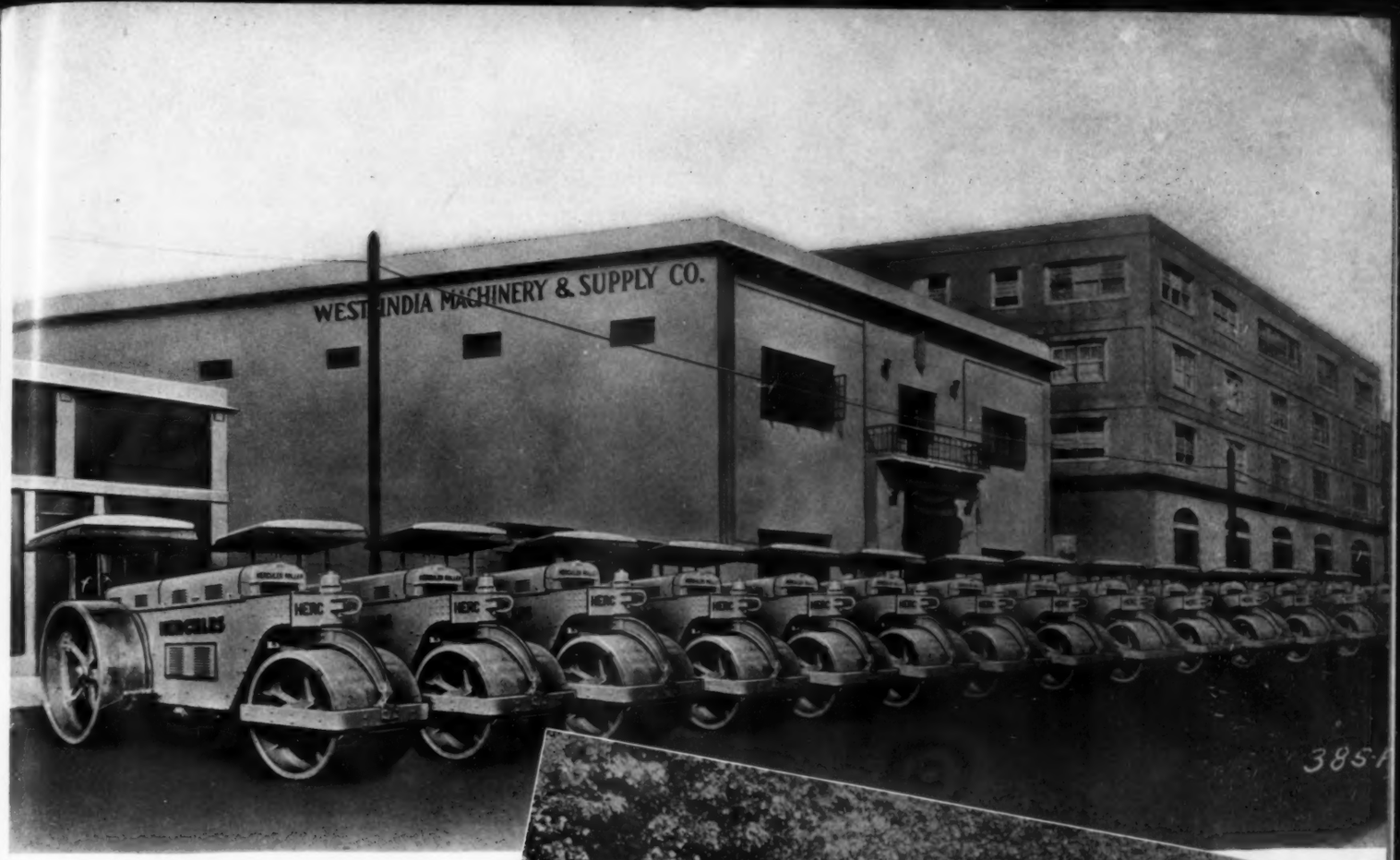
Factory test of V-16 320 bhp. Gleniffer Diesel.

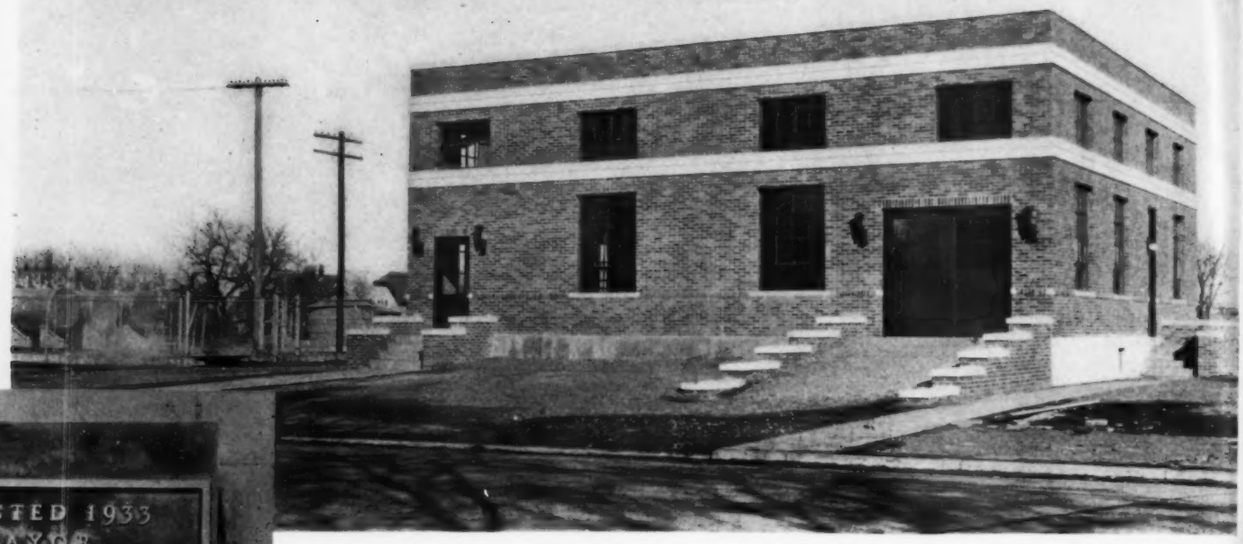




The Puerto Rican Reconstruction Administration recently ordered fourteen 10-ton Diesel powered road rollers. This order was obtained by the West India Machinery and Supply Company of San Juan, local distributors for the Hercules Company, manufacturers of Hercules road rollers. These rollers are all powered with Cummins Diesel engines and represent probably the largest single order ever placed for Diesel powered equipment of this type.

The Castino Transport Company uses an FWD tractor truck equipped with a Cummins Diesel. This truck, which has a capacity of 72,000 gross and with its two huge semi-trailers, makes from 25 to 40 two hundred-mile trips a month. After 115,000 miles of continuous service the operator reports, "We find the amount of fuel is about half that of gasoline. This means a saving of 2 cents per mile on fuel."

DIESELS AT HOME AND ABROAD



REMSEN, IOWA

By R. W. STROHMEIER

ERECTED in the fall of 1933 and placed in operation on December 18th of that year, the Municipal Electric Plant at Remsen, Iowa, has in the short space of time since then become one of the best known small town plants in the country, and has a record of achievement which Remsen citizens and officials believe to be superior to that of any plant operating under like circumstances.

The population of Remsen is less than 1,200 and the plant is in competitive operation, the present private utility franchise being in effect until February, 1937. Through the provisions of an old street lighting contract, which likewise does not expire until February of 1937, the plant has been deprived of the street lighting revenue, the private competing company still carrying this load as well as that of some twenty-five or thirty of the approximately 450 total customers.

In spite of this handicap, and with two substantial rate reductions since operation began, the plant has, from operating revenues only, accomplished the following in 28 months:

Cost of plant in excess of funds available, and since paid in full from earnings	$7,105.00
Bonds retired (none due until Nov. 1936)	6,000.00
Premiums paid to secure bonds ahead ahead of maturity	200.00
Interest paid from earnings	3,650.00
U. S. Savings bonds, purchase price	3,450.00
Fuel and supplies on hand	800.00
Cash on hand and accounts receivable	6,125.00
	$27,330.00

Against this, accounts payable amount to approximately $400, and interest accrued but not due to $1,630. In addition, profits of nearly $3,000 were lost to the town through the street lighting contract.

The last previous rate reduction (July 1935) was a flat 10 per cent discount from the old rates, the new rate schedule being as indicated below. A further and probably greater reduction is contemplated during the present year.

LIGHTING

First	50 kwh. per month	@ $ .072	per kwh.
Next	50 kwh. per month	@ .054	per kwh.
Next	100 kwh. per month	@ .045	per kwh.
Next	800 kwh. per month	@ .027	per kwh.
Over	1000 kwh. per month	@ .0225	per kwh.
Minimum bill		.90	

RESIDENCE OPTIONAL (YEAR CONTRACT BASIS)

First	50 kwh. per month	@ $ .072	per kwh.
Over	50 kwh. per month	@ .027	per kwh.
Minimum bill		3.00	

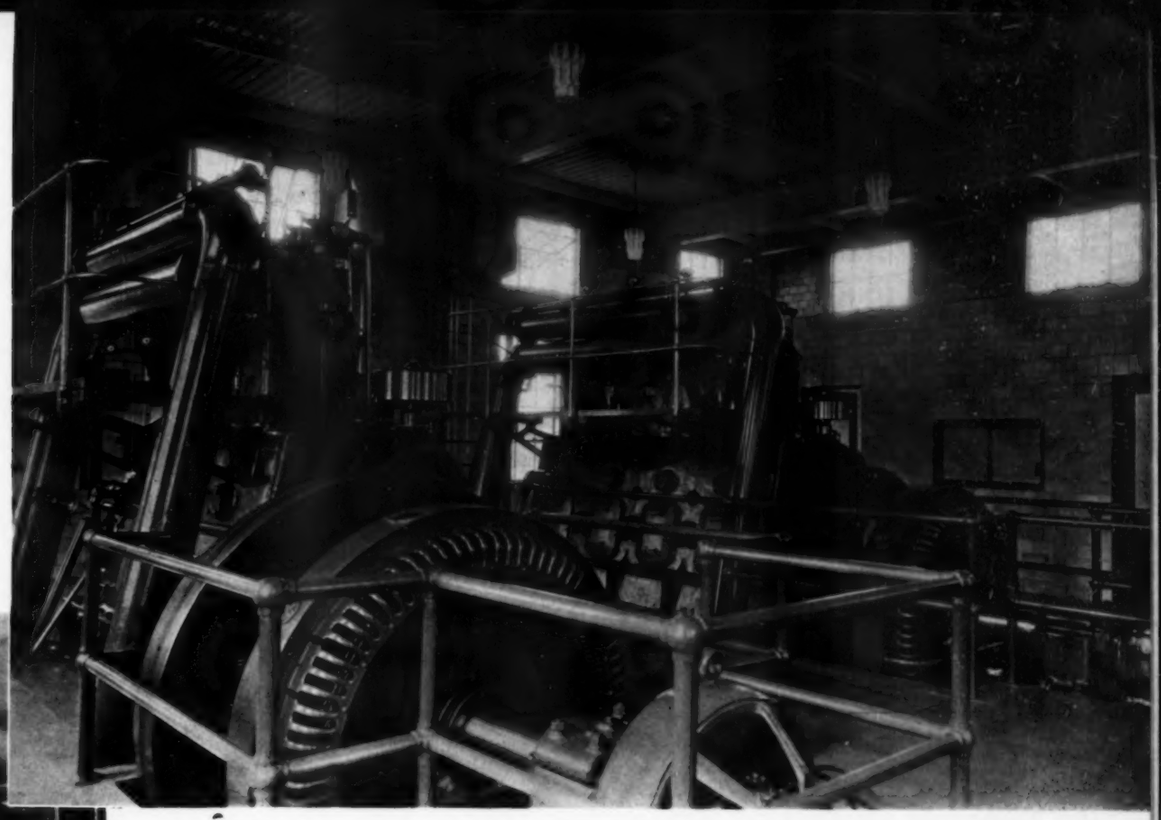
POWER

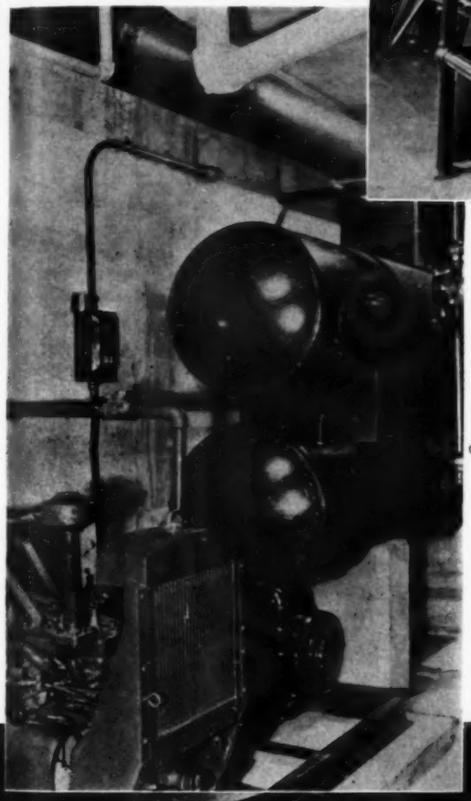
First	50 kwh. per month	@ $ .054	per kwh.
Next	50 kwh. per month	@ .045	per kwh.
Over	100 kwh. per month	@ .027	per kwh.
Minimum bill:			
One to five hp.		$1.00	per hp.
Five to ten hp.		.675	per hp.
Over ten hp.		.225	per hp.

WATER HEATING ("OFF PEAK")

All kwh. per month		@ $ .0135	per kwh.
Minimum bill		1.80	

Remsen, Iowa, has every reason to be proud of this municipal plant. In appearance as well as economy it is an asset to the community. Interior views how the De La Vergne Diesels and the Ingersoll-Rand air compressor.





During and after completion of the plant a very active campaign resulted in connecting approximately 95 per cent of available services to the municipal supply. Continued efforts to promote customer good-will through excellent service and frequent reminders to consumers that the plant's success is to their benefit and active efforts to build load through promoting better lighting, electric cooking, refrigeration, water heating, etc., together with the stimulating effect of the rate reductions have combined to show a rather remarkable load growth. All load is of a residential and commercial nature, there being no industrial load available.

During 1934 a total of 418,660 kwh. was generated, and in 1935 this figure mounted to 483,850, an increase of 15.6 per cent. For the first four months of 1936 an even greater increase over the corresponding period of last year was made, the gain being just short of 20 per cent. From present indications, it is expected that this rate of gain will be equalled, if not exceeded, for the entire year, making the total approach the 600,000 mark.

Physically, the plant consists of two De La Vergne engines of 3 and 4 cylinders, being 240 hp. and 320 hp. respectively. They drive General Electric generators having direct connected exciters. Both engines are equipt with Alnor pyrometers and MotoMeter distant reading thermometers.

A small, but very complete ebony asbestos switchboard carries the low voltage instrument and exciter circuits only, the bus structure being located several feet to the rear with ample light and working space on all sides. The oil switches are operated through tie rods and bell cranks under the main floor. The main floor is clear of all else, the accessories all being located in the full basement.

Duplicate Viking fuel transfer pumps, remote controlled from the engine room floor, and duplicate Goulds circulating water pumps are cross connected so that either pump may serve either engine in their respective capacities. A combination motor and gas engine driven compressor maintain starting air pressure in the

. . . . *And now please turn to page 57*

ATLANTIC HIGHLANDS, N. J.

By E. SCHOONMAKER

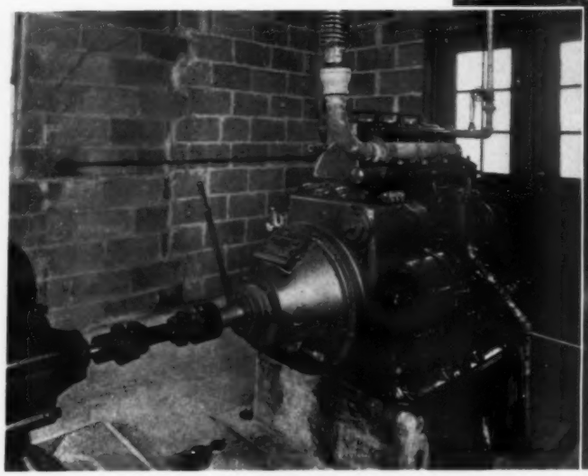
THE Atlantic Highlands, N. J., Water System of early days, consisting of individual, outdoor hand pumps, would hardly meet the present requirements of this thriving seashore community. The influx of summer tourists, vacationists and excursionists from New York City and other nearby places by steamer, train, bus and automobile, swells the normal population of 2,500 by 6,000 or more. This places a big responsibility on the Borough for a dependable water supply, with which to safeguard life and property.

The history of borough pumping dates back to 1891. With the incorporation of Atlantic Highlands, plans were formulated for the creation and development of a Municipal Water System. Within two years mains were laid, wells were drilled, the pump house was built and the best steam equipment purchased for pumping. The high cost of operation was soon apparent. Aside from the expense for coal, three engineers, three firemen and one coal passer had to be paid. Repairs had to be made. The water plant revenues were insufficient to compensate for the $18,000 yearly loss.

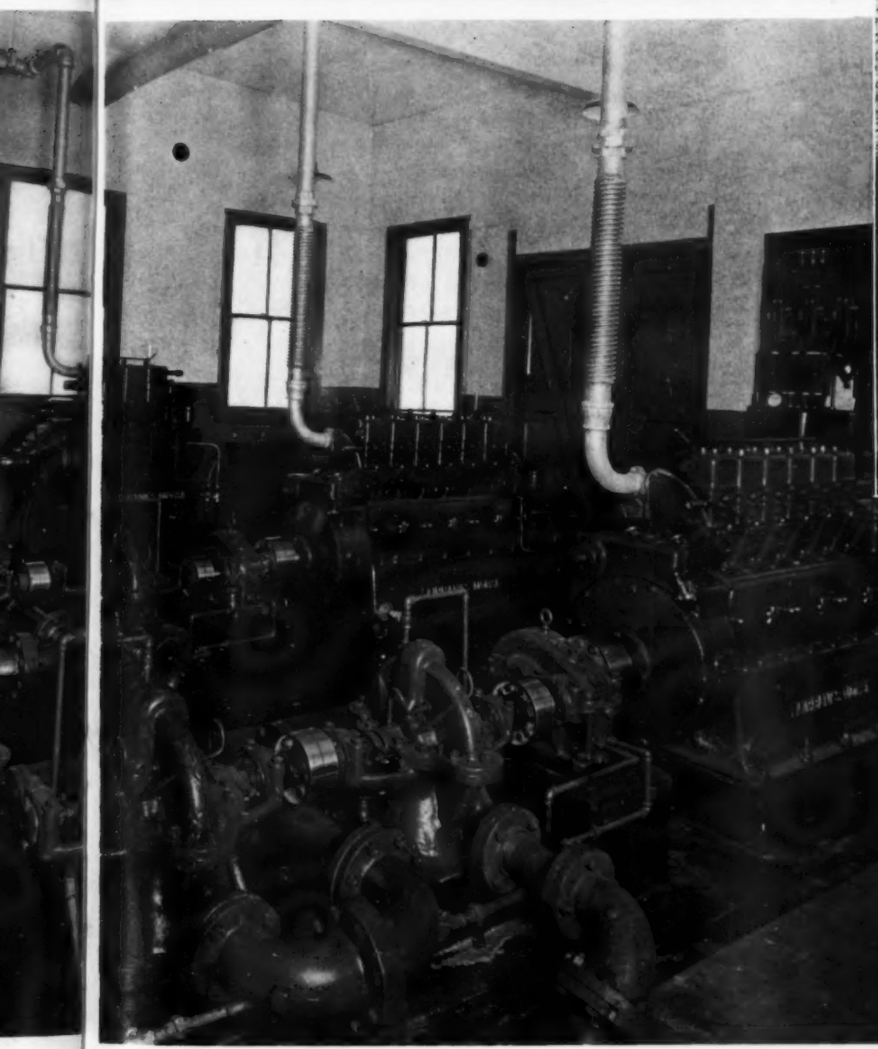
Faced with making a change, the Borough Council considered the suggestion made by Councilman C. C. Phillips which was to employ Diesel engines for pumping. This was in 1920 when Diesel development and application was not so far advanced as now; but, nevertheless then recognized as an economical and reliable source of power. However, the Borough Council decided to try electric motor pumping, apparently unmindful of the fact that daily power savings created by Diesel engines would have soon paid off the added investment required. As soon as the transition from steam to electric motor pumping took place, the expense for coal and one engineer, one fireman and one coal passer was eliminated. These economies and considerably less repair expense soon put the water works plant on a paying basis. It reached a yearly maximum profit of close on to $2,000 — but not for long. The demand for more water grew. Longer periods of pumping were necessary. This brought the power cost up to about $8,000 a year and rapidly dwindled the water plant profits.

By this time the Council began to recognize the claims made for Diesel engines by other water works operators. The results could hardly be ignored. This, and the high purchased power pumping costs brought the power question to a climax again in 1935. Led by C. C. Phillips, who was and is now, Mayor, the change to Diesel pumping was not accomplished without the usual fight against selling the plant to private interests. They successfully opposed the Utility Company in the courts, who sued to restrain them. This cleared the way for bidding, in which Fairbanks-Morse was successful. During the early part of 1936, the actual installation of Diesel pumping equipment began. In the space occupied by the obsolete motor pumps, three Fairbanks-Morse Diesel engines and pumps were installed.

The Borough of Atlantic Highlands obtains its water from two deep wells. The first one is located in the main pump house and is 180 feet deep. A Fairbanks-Morse turbine pump, driven through right angle gears by a 30 hp., four-cycle Diesel engine, lifts water from it at 400 g.p.m. The second well, 580 feet deep is located back of the main plant. Here in a suitable housing, a 40 hp. Diesel engine drives another deep well pump, which has a capacity of 750 g.p.m. The total input of 1,150 g.p.m. is pumped to the outdoor receiving well during the course of which it is aerated. When and as required, this water is then pumped into the filters and from the filters into the water mains and standpipes. The work is done at very low cost by two Fairbanks-Morse series connected booster



Power plant for second well located in this building consisting of a 40 hp. F-M Diesel connected to a 750 g.p.m. deep well pump.



pumps, driven through Link-Belt speed increasers by 60 hp. Fairbanks-Morse Diesel engines. Each unit has a capacity of 350 g.p.m. and usually operates against a 120 lb. head. A Twin Disc clutch gives a flexible mechanical connection between the Diesel and the right angle, deep well pumping unit.

Two men operate the plant from 6 A.M. to 11 P.M. each day, during which time the pumps are working, but not constantly. In the off hours water is taken from the standpipe atop the highest point on the Atlantic seaboard. Its capacity is 178,000 gallons of water, which is maintained through switchboard control. As the water drops a foot, a red light warns the operator of the shortage, who immediately starts the booster pumps. In case of fire, day

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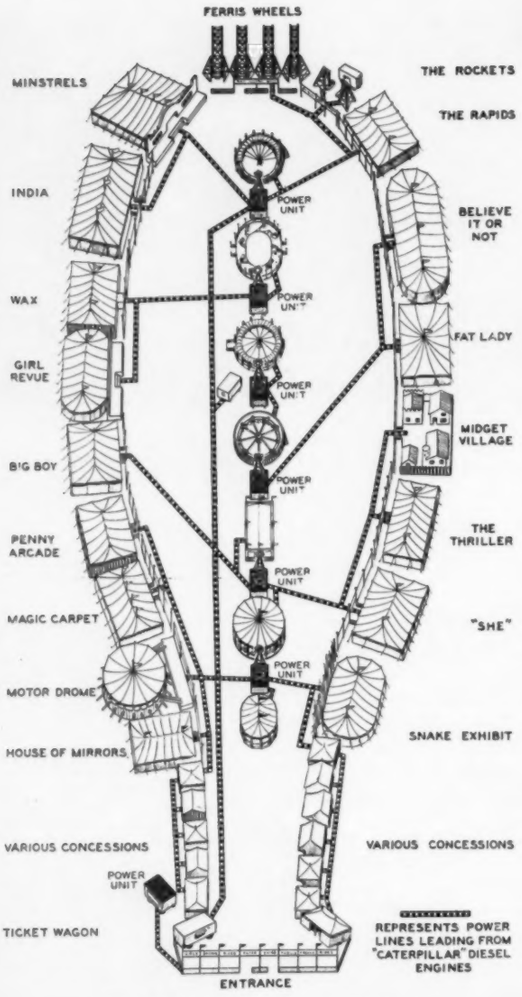
ROYAL AMERICAN SHOWS DIESELIZE FOR SAFETY AND ECONOMY



Ground plan of Royal American Shows. Note the position of the Diesel units — how they cover thoroughly the power and lighting requirements.

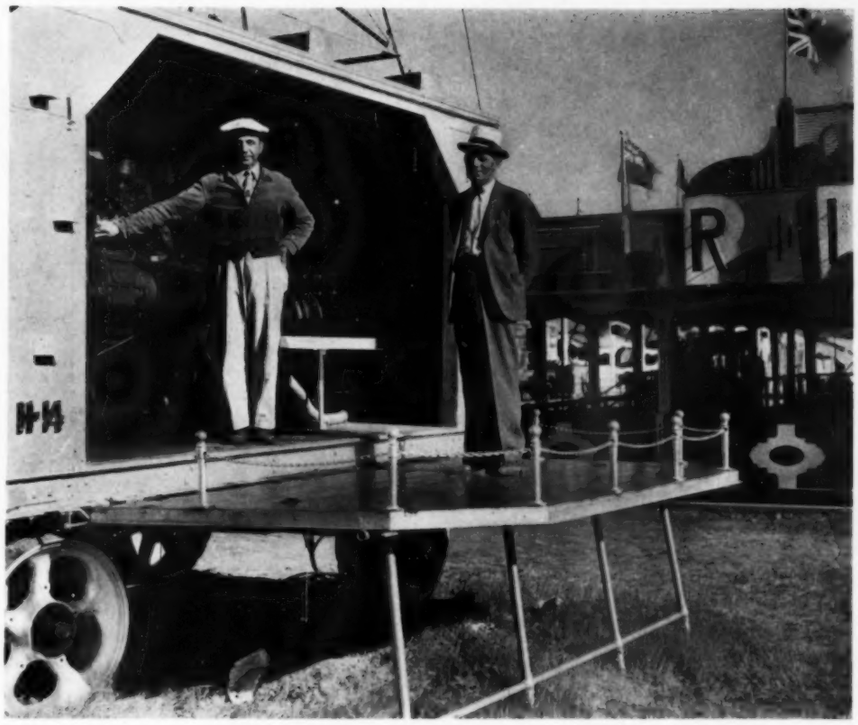
DUSK falls over the mile-horseshoe of Royal American Shows' great Midway. Then the purring of seven Diesel power units is heard, and the semi-darkness is transformed into an aurora, brighter than day in its contrast. Great searchlights sweep the sky, beckoning to carnival fans for a radius of many miles. And it isn't long until those great crowds are pouring in between the prongs of the Midway horseshoe.

The ballyhooers begin their chant, and another night has begun for Royal American. Carl J. Sedlmayr and the brothers, Elmer C. and Curtis J. Velare, owner-partners of the big theater-tent-shows, look out from their brightly lighted wagon-office with smiles of satisfaction, for their "Brightest-Lighted" Midway won't cost them $40,000 in purchased electric current in 1936, as it did last year. Those seven 125-horsepower Diesel engines, the owners claim, will pay for themselves in savings, in a couple of seasons.

The units, purchased from the Peoria Tractor & Equipment Co., "Caterpillar" distributors, during Royal American's stop at Peoria, Ill., in the summer of 1935, and installed at Tampa, Fla., quarters last winter, form the most unique installations in the history of Diesel engines, according to George Fenn, who represented the distributor in the transaction.

Each unit is composed of a six-cylinder, 125-horsepower "Caterpillar" Diesel engine direct-connected to a General Electric 60-kw., AC generator. Six units are 120-V, single phase generators, and the seventh is of the 120-208-V three-phase type. These Diesel sets have been installed in fourteen feet by eight and one-half feet by eight feet wagons which are bases for floodlight towers 67 feet high. On each tower top is mounted a ton of floodlights. The towers themselves, of steel and aluminum framework, are collapsible, occupying little space when folded down and stored inside the wagons. These power wagons and all other rolling equipment are quickly hauled between railroad siding and carnival lot by "Caterpillar" track-type tractors owned by the Show.

Six of the power wagons are set up in a single line down the middle of the great horseshoe-shaped midway. The other stands near the glittering entrance at the opening of the horseshoe, and lights the thousands of bulbs and



Nath Nelson, Chief Electrician, and Vince T. Book, Master Mechanic, with one of seven 125 hp. mobile Diesel units upon which the Show relies for all power and light.

strings of multi-colored neon tubes set in the huge archway that welcomes the patrons to the midway.

The three-phase generator set is located at the far end of the line. It has a quadruple job: Powering its battery of floodlights, the major rides, the lights for the ticket and cashier's wagon, and supplying current for the electrically-heated snake pens. The reptiles must be kept at constant temperature, and the source of heat can be only electricity.

The other four units in the line power their own floodlights, and through short cables, the lights in the circle of show and concessions tents and booths. Floodlighting for each set requires from 10 to 15 kilowatts, leaving the remaining 45 kilowatts to light and power the show.

The Show's power load is 400 kilowatts at peak load, so the seven units have 20 kilowatts available as reserve power. Only half the cable previously carried will be taken along this year as, with one exception, the maximum single length needed will be only about 75 feet from power unit to show or riding device. Centered as they are, the units supply their specific outlets by direct-line cables, eliminating the old method of stringing in long lengths from the nearest power transmission line.

Compared to that $40,000 power bill last year, this year's light and power expense will be of minor consideration, according to Vince T. Book, master mechanic, for the Show's consumption this season has averaged 4½ gallons of 6-cent fuel oil (contracted ahead) per hour. Lubricating oil is changed every 70 hours of operation. The Show lasts 6 hours a night, 6 days a week. Six of the Diesels work during this period, but the seventh runs 24 hours a day, drifting on the line because of numerous odd jobs, including the snake heaters.

All in all, the owners estimate their total fuel expense for their 1936 light and power year at less than $5,000. But that's only one advantage they claim. The Diesels, developing the required 120 volts at all times, serve better and supply brighter, steadier lighting than the variable flow of current obtained from many cities whose normal load contains considerable fluctuation. The Diesels eliminate costly construction, stringing poles and lines to the lot. The best sites can be selected without consideration of power line location. And all these blessings swell the nightly receipts and shrink the rolls of tickets.

There's another reason why the dependable

The Show moves on and takes its power with it. Three Diesel units leaving the lot at Peoria Heights, Illinois.

Diesels were chosen—Safety. The Show's ticket wagon could be called its "bank," and it's a cash bank at that. Showmen, master psychologists that they are, know that a bandit shuns the light. That's why ticket wagon and portable office are in a constant glare of light, and "stick-ups" are almost unheard of. Then again, just suppose the lights went out while the ten snarling lions were being whipped through their paces in the pit of the motordrome. What would happen to Trainer Riley?

Probably no organization can equal the Midway for mechanical ingenuity. Royal American Shows has Vince T. Book, master mechanic, and Nath B. Nelson, chief electrician, both veterans in carnival machine technique. Every one of the large fleet of wagons was designed by Book. When the order came to add Diesels to the Show's rolling stock Book set to work in winter quarters at Tampa to produce the seven necessary additional wagons. The work was well under way while the engines were being shipped by coastal steamer, yet when they arrived the precision with which the wagons were built came to light. In length there was just three quarters of an inch clearance when the Diesels were lowered into place. Foundation bolts fitted perfectly. In addition, however, Book devised and installed special outlets for crankcases and fuel pumps. All gear, including the towers and tower lights, fit exactly into the various wagons with nothing left out and little or no room to spare.

Electrician Nelson's carefully laid out power distribution system is the last word in balance, drawing the most from each engine without overloading any one unit. Results prove that he knows footage cost of power lines also. When he was finished he was only temporarily satisfied. He wanted to make Royal American's old dream come true — to brighten up the Midway with the liberal use of neon tubes. Formerly he had been handicapped by lack of power. He had plenty now from those seven Diesels. Transporting the glass tubes was the chief obstacle, but Book took care of that through special shipping cases and a glass blower was hired permanently to add to the supply and replace breakage, if any.

In the United States Royal American plays chiefly in cooperation with major state expositions. The first stop out of Tampa last year had everything in the way of natural advantages and when the owners took their first look at the new Diesel powered Midway with its blue-white searchlights, its golden-lighted towers and chains of multi-colored neon outlining the various concessions they received the most pleasant shock of their lives. It was then that they inserted "best lighted" along with "world's largest" on the advertising posters.

J. E. Dadswell, advertising manager for the show, heartily approves the change in power. "These Diesels have put new life into our business," is the way he put it. "We live on light. More light means more customers and, obviously, more profit.

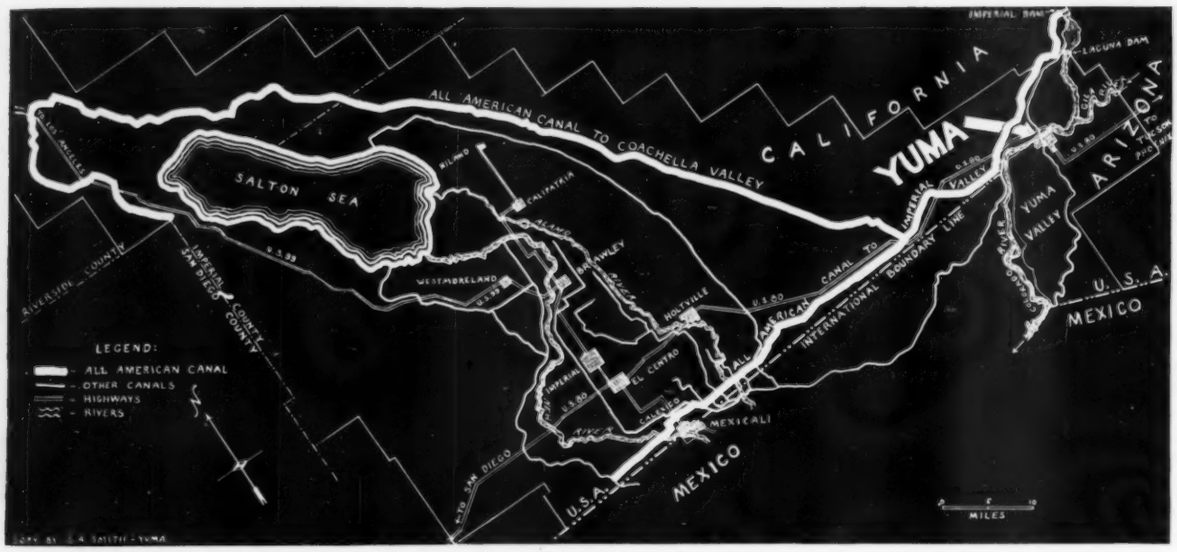
"The Scooter is our most popular ride," continued Mr. Dadswell, "and it takes 40,000 watts to operate it properly. With Diesels and an abundance of inexpensive power the little automobiles keep going at a fast clip throughout show-time. It is better lighted, too, yet that is only part of the job of one Diesel.

"When we were buying power, our construction costs were tremendous. Pole setting is an expensive proposition and was a major item in the total power expense during the seasons preceding the installation of our Diesels."

The master showmen of Royal American never overlook a "bet" which has any public attention value whatsoever. They point out that by "dolling up" the Diesel engines and their wagons with polished brass rails and well applied paint they have actually made the seven units into an entertainment feature for the crowds. Ample evidence that their psychology is correct, as usual, is produced at every stop. The humming, shining Diesel engines are continually surrounded by interested spectators. It is small wonder, therefore, that they are groomed daily by a mechanic, whose job is to keep them absolutely spotless.

What a realm for the Diesels to star! Surely, the Midway proves that the Diesel engine has what it takes. Economy, dependability, portability — the Shows require them all. Royal American Shows is No. 1 Diesel-powered Midway. The outdoor show world is watching the performance of these engines with keen eyes. It looks like the conquest of just another new field.

Just suppose the lights went out with lions in the arena and this thirty-two foot "Regal Reticulated Python" being shown off before the crowds who nightly fill the great horseshoe. But they won't — Diesels see to that. The "Skooter" ride, one of many attractions, draws 40 kw. to keep the little automobile buzzing about. This is only a small part of the power furnished by Diesels.



Map showing the All-American Canal System, United States Bureau of Reclamation operation.

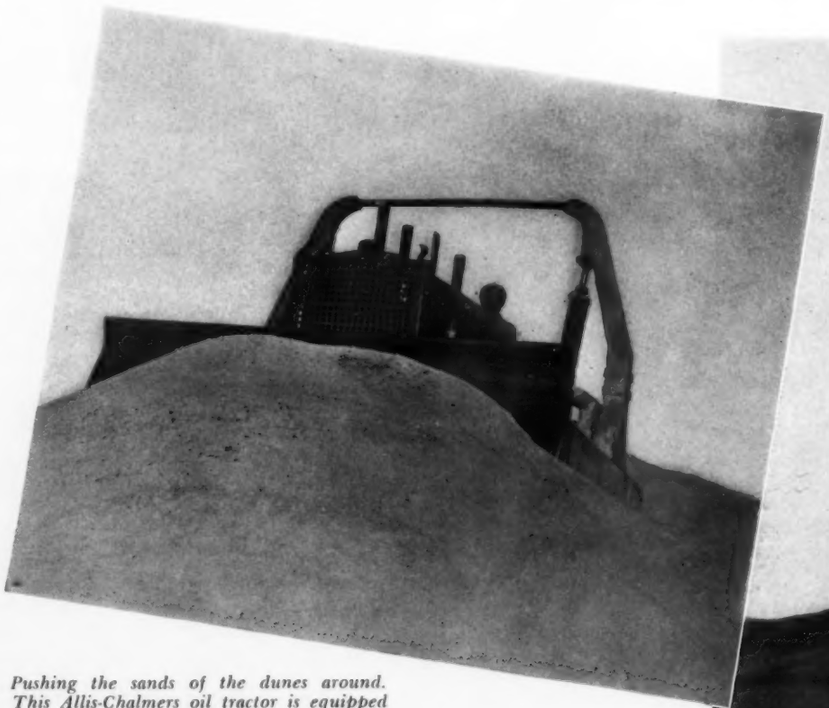
ALL-AMERICAN CANAL IS ALL-DIESEL

By F. HAL HIGGINS

BOULDER DAM is done and turned over to the U. S. Government by the Six Companies, as one of the greatest engineering feats of man. But down the Colorado River 130 miles a second dam, Parker, is starting construction to feed the Colorado River Aqueduct, a little 242-mile, $226,000,000, man-made carrier that will take out enough water from the river to supply present and future needs for Los Angeles and a dozen of its surrounding cities.

Still another 100 miles down the so-called "silvery Colorado" is starting Imperial Dam, and here a great de-silting plant is being built to drop the yellow silt that makes the Colorado anything but silvery. And here, 25 miles above Yuma, starts the All-American Canal, an 80-mile, $34,000,000 job of leading across the desert sands of the shifting dunes water enough to double the present rich acreage that makes Imperial Valley one of the most marvelous farming areas in the entire world. Some 40,000,000 yards of dirt must be moved. In that valley are produced in trainload quantities the cantaloupe, head lettuce, water melons, peas, carrots, etc., to meet the demands of metropolitan consumers. Nowhere else in the world has "programmed agriculture" by the utilization of tractor power in the hands of brainy and market-wise farmers reached such perfection.

For the past eighteen months, this third phase of the harnessing of the Colorado River has been progressing with amazing speed and efficiency in spite of heat hazards that take the thermometer up to 120-to-130-degree marks for months. Most of this stretch of canal building



Pushing the sands of the dunes around. This Allis-Chalmers oil tractor is equipped with bulldozer to shape up the banks of the canal behind the pair of Diesel powered draglines; one Atlas Imperial and one Worthington, each in a Bucyrus-Erie dragline.

is across uninhabited desert where shifting dunes keep the highway department continually digging and sweeping to keep the paved road open between Yuma and El Centro, capital of the Imperial Valley.

One surprising thing about this job is that contractors have all gone Diesel in the engines that power their tractors, draglines and shovels. Griffith Company of Los Angeles; Boyce & Igo of Baton Rouge, Louisiana; W. E. Callahan Construction Company of St. Louis; H. Gunther and J. P. Shirley of Omaha; Lewis-Chambers Construction Company, Inc., of New Orleans; Morrison-Utah-Winston of San Francisco; and George W. Condon of Omaha are all-Diesel. Condon's and Boyce & Igo's jobs are sub-contracts.

While several old veterans of the Mississippi levees and the Madden Dam in Panama were brought in by Boyce & Igo and W. E. Callahan, most of the other equipment came on the job new. The old Bucyrus Monigans that swing 10- and 12-yard buckets at the ends of booms as long as 160 feet are powered by Fairbanks-Morse 350 and 450 hp. Diesels. To say that they have seen plenty of service is putting it mildly. These big babies have set dirt-moving records under the toughest conditions of rainy weather and swamp to be found in the western hemisphere. Seven of these giant Monigans of 3- to 12-yard buckets are on the job. Now they find themselves up against heat and sand and carry on just as

One of the three Allis-Chalmers oil tractors on the George W. Condon job near the Imperial Dam site on the Colorado River, which is pulling the Adams elevating grader that is powered by the International Harvester Company engine that powers the belt on the elevator.

efficiently — more so, as they are never stopped by weather here.

A year ago when the writer saw the All-American Canal job from the river above Yuma to its farthest west activity, it was confined to the work of Griffith, Boyce & Igo, Callahan, and Shirley & Gunther contracts. Their big walking Monigans were all Fairbanks-Morse Diesel-powered, while both oil and Diesel tractors were in use for hauling wagons in the rocky going, bulldozing and choring around the job in getting oil, fuel, parts, etc., from depots to machines on the jobs.

Now, with the start of the desilting and Im-

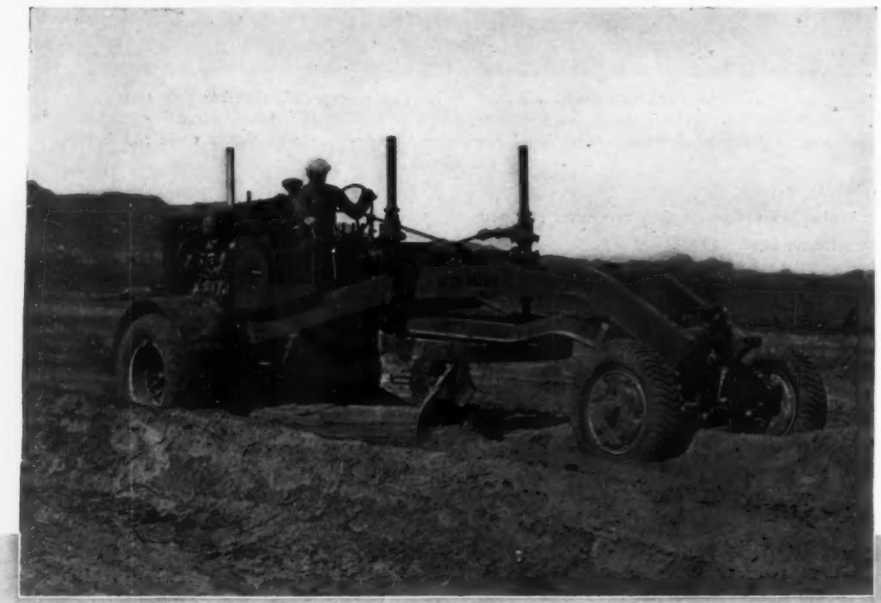
A Bucyrus-Erie dragline with Worthington Diesel engine is performing beautifully here in temperatures that range up to and above 130 degrees at below sea level.

perial Dam jobs, there are many new contracting firms and pieces of equipment on the job. George W. Condon has the sub-contract for moving about 2,000,000 yards of dirt here for the desilting plant, and he has not only brought in four oil engine-powered units in a Northwest shovel powered by Twin City engine and three Allis-Chalmers L O Oil tractors for bulldozing and pulling an elevating grader, but he introduced to the Pacific Coast for the first time the Euclid wheel Truck Tractors instead of the conventional track wagons pulled by track tractors for moving dirt. As this man Condon has moved some 6,000,000 yards of dirt the past two years with this kind of equipment on dams in Nebraska, road jobs in the short-grass states and on other lesser items, he has developed a reputation of taking the low bidder's dirt-moving contracts off their hands at a profit to both parties. Speed has been added by changing over from tracks to the big air-tired wheels, he says, and his superintendents admit he has been cutting a third off the cost of moving a yard — or a million yards — of dirt. That's the kind of fundamentals that start revolutions.

At the same spot where Condon is making history with his Euclid wheel equipment, Morrison-Utah-Winston have a Diesel-powered compressor working on the temporary bridge across the Colorado; a new Speedster crane mounted on a truck is being used to unload bar steel for concrete reinforcing. This outfit is powered by a Caterpillar Diesel. Three more Northwest draglines powered by Twin City oil engines are here at this spot on subcontracts.

At the far end of the activities, just beyond the west edge of the dunes, is a new Fairbanks-Morse Diesel-powered Bucyrus-Erie dragline. This is another of Callahan's outfits with great traditions to aim at, traditions made by the old battle-scarred veterans that are working miles back on another sector.

So, when you order your cantaloupe, honey dew or watermelon, give a thought to the great job the Diesel engines are doing out there in the desert to bring you more and better out-of-season vegetables in high quality carload lots. They are putting the life blood of guaranteed farming profits into the desert sands.



Left — Diesel powered road machine keeps working over the surface of the roads traveled by the high speed big air-tired wheel track tractors. Below — At Imperial Dam on the Colorado river, just above Yuma, Davis & Tarleton's Northwest dragline powered by Twin City oil engine at work on the All-American Canal.

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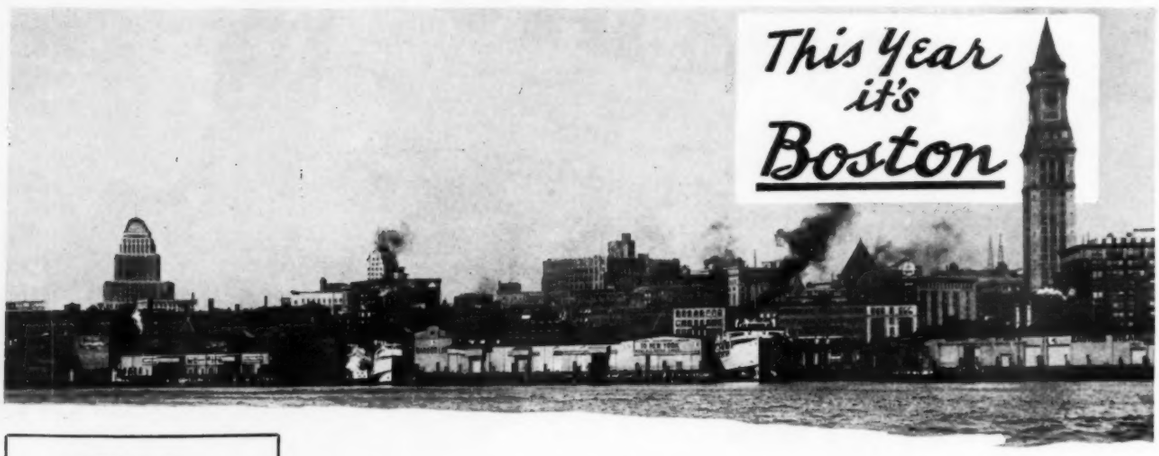

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American Merchant Marine Conference

HOTEL STATLER, BOSTON

September 28, 29 and 30, 1936

THE Propeller Club of the United States again sponsors the American Merchant Marine Conference, this year in conjunction with its Tenth Annual Convention . . . The new Merchant Marine Act, 1936, presents new problems to the American Marine Industry . . . The Conference will afford a medium for the discussion of these and other matters, with the objective of improving conditions within the industry, the further development of public interest in American shipping, and the advancement of the American Merchant Marine in all its branches . . . Prominent speakers will deliver addresses of vital importance . . . General discussions will be encouraged . . . Conference sessions will be held on Tuesday, September 29, both morning and afternoon . . . on Tuesday evening will be held the Annual Merchant Marine Conference Banquet . . . Propeller Club Convention sessions will be held on Monday, September 28 and Wednesday, September 30 . . . Entertainment features have been arranged—sight-seeing trips, inspection of Boston Harbor, golf tournament for Propeller Club members and guests, entertainment for the ladies . . . Plan now to attend the Conference and the Convention . . . The opportunity for further constructive work is at hand . . . Your help is needed in this program for the permanent development of the American Merchant Marine.

JOHN J. HALLORAN
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The Propeller Club of the United States

September 28, 29 and 30, 1936

National Headquarters, 17 Battery Place, New York

SUPERCHARGED DIESEL ENGINES FOR SEA GOING MOTOR SHIPS

By B. J. VON BONGART

THE Anglo-Saxon Petroleum Company of London has in service the *Genota, Gadila* and *Alexia* motor tankers, powered with supercharged Diesel engines.

The engines are of M.A.N. manufacture; they are of the eight cylinder, four stroke cycle type of 25½ inches bore and 55 inches stroke. In letting the contract for building these engines, the Anglo-Saxon Petroleum Company specified that the engines must deliver 3,500 horsepower at a speed of 120 rpm. and not less than 2,700 horsepower at 110 rpm.; that the engines must be of the four stroke cycle type and supercharged. It was also specified that the supercharger be an integral part of the engine proper rather than an additional unit driven off the crankshaft of the engine, or driven by a separate motor or by an exhaust turbine. Utter simplicity and compactness were the fundamental demands.

The M.A.N. in meeting these specifications made use of a closed piston, the upper part of which faces the combustion chamber producing the power, and the lower part acts as an air-compressor. The M.A.N. engine is illustrated in Fig. 1.

Fig. 1 Supercharged 8-cylinder M.A.N. 3,500 hp. Marine Diesel engine

A supercharger, which must also perform the duty of a scavenger – i.e., expell the exhaust gas residue which usually remains within an engine's combustion chamber – must have a capacity in excess of actual requirements. Provision is usually made to supply 1.6 times the quantity of air needed; this, therefore, allowing for dissipation losses, calls for a supercharger able to handle about twice the amount of air normally drawn in by the descending piston of the engine during the suction stroke.

In this M.A.N. design of four stroke cycle engine operation, compressed air is required for every fourth stroke of the piston, but the lower part of the piston, acting as a compressor, supplies air at every second stroke, and hence furnishes twice the amount of air needed. The efficiency of an air-compressor is perhaps 85 per cent, and when allowance is made for dissipation, the actual supply of air fed to the engine's cylinder may well be reduced to 1.6 times that of the actual quantity needed, a condition readily met by the arrangement worked out in the M.A.N. design. The scheme is shown graphically in Fig. 2.

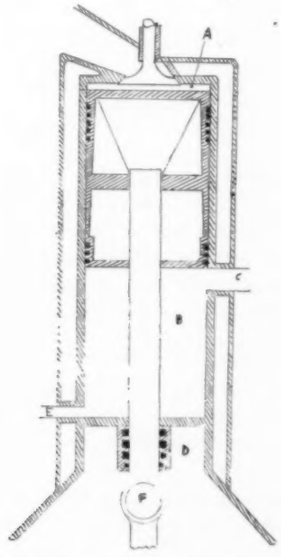
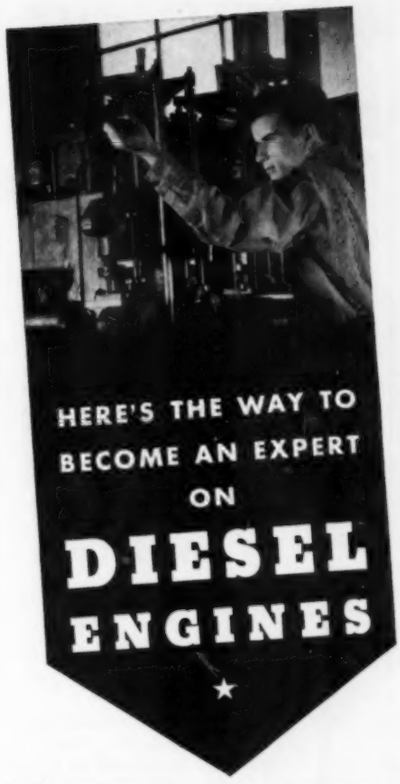


Fig. 2 Schematic diagram of compressor. A – combustion chamber; B – air compressor; C – air inlet; D – stuffing box; E – air outlet; F – cross-head.

Of course, using a piston for this dual purpose is possible only with engines of the cross-head type, for engines designed with the usual connecting rod, a two-diameter piston will produce the same results, Fig. 3.



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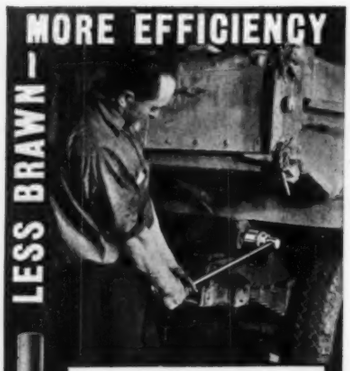

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The two-diameter piston compressor as shown in Fig. 3 will also supply a surplus of air if used in connection with four stroke cycle engines, since there, too, the piston makes two compression strokes for every working (suction) stroke, thus assuring an ample supply of compressed air.

This type of construction is finding favor abroad in connection with medium duty engines, since the cross-head type makes for too heavy a construction to be suitable for such engines. Heavy duty engines, on the other hand, are usually of the cross-head type, a construction permitting heavier reciprocating parts. Also, the factors of expansion and contraction will affect a two diameter piston and may cause distortion and loss of compression.

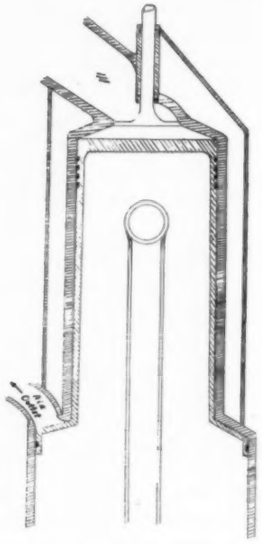

Fig. 3 Two-diameter piston compressor

Large engines must of necessity (to absorb the thrust) be of the cross-head design – costly to produce – nevertheless, there is a decided tendency to employ the simpler (and far cheaper) connecting rod construction as shown in Fig. 3, even for comparatively large engines, i.e., engines up to 24 inches and even up to 26 inches bore.

In the case of the smaller Diesel engines (up to 50 hp. per cylinder) not much attention is being paid to piston cooling; the splashing oil (within the crankcase) and the piston rings are usually relied upon to dissipate the heat. With larger engines, oil cooling of the piston is the usual practice, the oil being fed under pressure through suitable piping. For really large engines, water cooling must be provided for the pistons, which, in the case of the M.A.N. engine, is accomplished by means of a so-called "trumpet," as shown in Fig. 4.

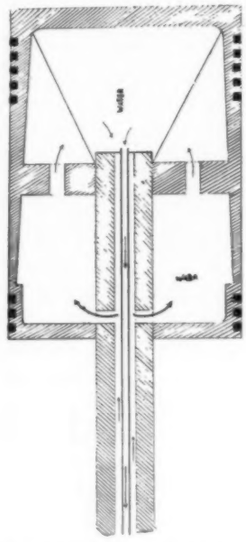

Fig. 4 Trumpet-type water feeding to cool piston

With most of the marine installations, the water used for cooling purposes is sea or river water, but with the M.A.N. engine installations as furnished to the Anglo-Saxon Petroleum Co., sea water is used only for the cooling of the cylinders. The pistons are cooled by fresh water, to which an anti-corrosive is added so as to minimize the formation of scale. The exhaust valves, too, are cooled with fresh water.

Aside from the supercharging, these M.A.N. engines embody features of note, to wit.:

The compression pressure of the engines is 540 lbs. per square inch. Yet, during the acceptance tests, the ignition pressure never rose above 640 lbs. per square inch.

Fuel is injected at a pressure of 8,500 lbs. per square inch. This feature permits fine atomization with nozzles of comparatively large openings.

The auxiliary pumps, the fuel pumps and the two bilge pumps are chain driven directly from the engine crankshaft.

The buyers (the Anglo-Saxon Petroleum Co.) specified that the engines must operate with a fuel of 0.90 specific gravity. Such heavy fuel being rather sluggish to handle by the fuel pumps, pre-heating of the fuel had to be provided for in order to increase its fluidity.

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During similar tests, the engine of the ship *Gadila* delivered 4,450 horsepower at 127 rpm., 27 per cent over and above the horsepower contracted for. Against a non-supercharged engine, this is an increase in horsepower of 73 per cent.

Ordinary (non-supercharged) Diesel engines of the two stroke cycle construction will produce a brake-mean-effective-pressure of from 75 to 82 lbs. per square inch, and four stroke cycle engines of from 90 to 100 lbs. The lower figures no doubt come closer to the results obtained in actual every-day practice, though, of course, there are a number of Diesel engines extant which do not reach even the lower figures.

The actual results obtained with these supercharged engines during five test runs are depicted in Tables 5 and 6. From the former it will be noted that the mean-indicated-pressure varied from 106.3 to 142 lbs. per square inch; the actual power output from 2,850 to 4,450 hp.; the mechanical efficiency from 80 to 85 per cent at speeds of from 115 to 127 rpm. The latter table indicates to what extent the power developed (fuel consumed) affects the exhaust gas temperature irrespective of cooling water temperatures.

Contrary to popular belief, supercharging Diesel engines does not increase piston temperatures, but rather reduces them if suitable (overlapping) valve timing is made use of.

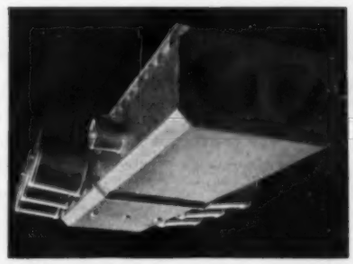
Rpm.	M.I.P.	Mech. Eff. %	Ind. Hp.	Actual Hp.
115	106.3	80.0	3,563	2,850
116	114.0	81.1	3,825	3,100
120	118.0	82.0	4,122	3,380
124	137.0	84.6	4,950	4,190
127	142.0	85.0	5,244	4,450

Fig. 5

Cooling water temperatures, °F				
Pistons		Cylinders		Exhaust
Inlet	Outlet	Inlet	Outlet	Temp. °F.
57°	98°	36.5°	54°	500°
100	106	91	104	626
92	98	72	93.5	644
104	117	102	115	800
84	104	37.5	59	878

Fig. 6

Under various tests, the fuel consumption varied from 0.36 to 0.415 lb. per horsepower hour according to engine speed and tempera-



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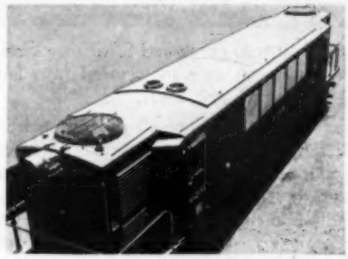

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The Burgess equipment was designed to accomplish its difficult tasks in the limited space available. Not only does this powerful locomotive operate in a Chicago residential district without disturbing the apartment dwellers, but Burgess air cleaners filter the intake, protecting the engine against lake sand, grit, and dust.

Burgess straight-through silencers and mufflers may be adapted to every form of Diesel engine without obstructing the flow of air or gas. Burgess impingement type low-restriction air cleaners offer increased protection for cylinders and lower maintenance.

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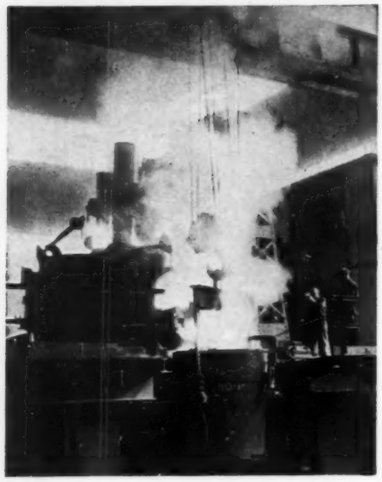

All National Forge and Ordnance Company products are manufactured from fine quality Basic Electric Steel.

Complete control of all processing from selection of the melting charge to the finished condition is National Forge and Ordnance Company's guarantee for maintenance of quality in crankshafts and various other types of forgings furnished to leading manufacturers in the Diesel industry.

BASIC ELECTRIC STEEL FORG'NGS

Carbon, Alloy, Corrosion Res stant and Special Steels Smooth Forged, Hollow Bored, Rough or Finished Machined, Heat Treated to Specifications. . . Forging Quality Ingots Pressed or Hammered Billets.

EMPLOYERS • **We have Diesel students and graduates everywhere.** • **Will appreciate an opportunity to help you.**

O. F. SCHOECK DIESEL SCHOOL
ALTON, ILLINOIS

ture maintained. The exhaust gas was practically invisible even at highest power outputs. The latter feature is directly due to the complete scavenging of the combusion chamber of exhaust gas residue and, of course, to the supercharging.

Universal adoption of supercharging four stroke cycle Diesel engines is bound to come. Whether the integral M.A.N. type of compressor – the two diameter piston seems a poor solution – will supersede the external separate type of compressor for large, slow speed Diesel engines is problematical. This much is certain: the supercharger has arrived and its future development and application richly deserve the attention of all interested in Diesel engine progress.

DIESEL FREIGHTER *WARRIOR*

. . . . *Continued from page 33* . . . .

for use with the elevator platform. This plank is wide enough to handle two-day traffic.

In the lower hold, next aft of the cargo hoist, are four cargo oil tanks, a unique feature providing limited tanker capacity for hauling fuel oil to out-of-the-way industrial plants as a part of the general cargo. These have a capacity of 150 bbls. There are two 1,800 gallon fuel tanks also. The main power consists of two direct reversing, four-cycle, trunk piston, six-cylinder Atlas Diesel Engines of 200 hp. at 350 rpm. One main engine has a 5 kw. Westinghouse generator, connected to a 56 cell, 110 volt 300 amp. Exide battery set. Another 5 kw. Westinghouse generator is belt driven off the auxiliary Diesel. These main engines have one-man centralized control. Because of the large compressed air load, an 80 hp. 8½ x 10 inch, three-cylinder Washington Diesel compressor set is mounted between the two main engines. It drives a two-cylinder, 360 c f m Ingersoll-Rand air compressor, and through an auxiliary shaft and clutches a 6 inch Northern rotary cargo pump, and a 4 inch Viking oil pump. A 5 hp. G.E. motor turns a Moran fire pump and a small auxiliary air compressor. Aft of the engine room are two 100 bbl. cargo oil tanks and two 500 fresh water tanks. The Diesels exhaust through a hollow steel mast, which is also the main cargo mast for heavy deck lifts as well as the silencer for the Diesels and tends to dissipate the exhaust gases high above the ship. A copper coil inside the lower portion heats water for radiators. The twin 52 x 46 inch Doran bronze propellers turn in full-size wooden tunnels, with the tips of the blades flush with the bottom of the hull. These tunnels are lined with Monel Metal, another unique departure. The propellers are supported on bronze struts and have "Aqualite" bearings of pressed linen.

The main deck is for cargo, a capacity of 600 tons for the ship, variable as to how much cargo oil is carried and how much load carried on the top deck. Two Elwell-Parker vertical lift trucks scoot the cargo, which is all loaded on skids, aboard and off again with but three men necessary. One is of the fork type and one combination platform and fork, each of three tons capacity. Steel deck covers are removable to give access to the engines. The upper deck has a large galley, with oil burning range, Fairbanks-Morse refrigeration, and ten cabins for the crew, each with hot water heat and running water. Officers' quarters are on the top deck. The latest type Photo-Electric Pilot, with full automatic electric steering gear is fitted, the only freight vessel in the United States inland waters so fitted. Extremely close tracking over a course is possible as well as easy steering, despite the fact the vessel has no keel and the winds hit her broad sides pretty hard when running up the Straits. She has a salt water sanitary system, powerful searchlights and all the extras found aboard the most modern vessel.

Because of her unique design and overall operating cost of less than 50 cents per mile, this craft is a money maker, besides being the largest of her type ever built. She can load 600 tons of pulp on skids in three hours while emptying her cargo oil tanks as a load on an outbound trip. Without her Diesel power plant, she could not have been built.

A perfected type of vessel of almost limitless economic usefulness throughout all parts of the country. An ideal design for river use.

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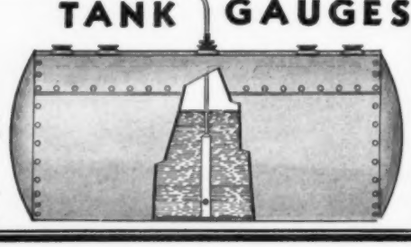

PETROMETER CORP.
1 Star Sq., Long Island City, N. Y.

REMSEN, IOWA

. . . . *Continued from page 41* . . . .

duplicate 2 ft. x 9 ft. high pressure tanks, as well as in a small low pressure tank which furnishes air for general use about the plant.

Mufflers are housed in at the rear of the building, and a small blower with ductwork and suitable dampers takes air from the basement and forces it through the muffler houses and wall registers to the engine room. This is the sole means of heating the building, excepting small electric radiators in the office and shop, and proved adequate during the past extremely severe winter. Intake air is filtered, the filter room being located between the muffler houses. Directly below is an airtight chamber which acts as a very effective muffler on the intake and making it almost noiseless. Combustion air is filtered through Owens-Illinois "Dust-stop" units.

Fuel oil is unloaded by gravity from the adjacent railroad siding to two 11 ft. x 30 ft. 21,300 gallon underground steel storage tanks, providing sufficient fuel storage for several months' operation and affording an opportunity to purchase a considerable supply when market conditions are favorable. Before the fuel oil enters the engines it passes through Cuno filters.

The cooling system is of the open type, jacket water being pumped through the engines and to a 25 ft. x 25 ft. spray pond 4 ft. deep. Circulating water is zeolite softened and treated to arrest corrosion.

Lubricating oil is centrifuged, using the continuous by-pass method. Unit No. 1 has operated nearly 19,000 hours to date on the original charge of oil with such additions as have been necessary. Rated horsepower hours of operation per gallon of lubricating oil for this period exceed 7,000.

Due to load conditions, No. 1 unit has operated most of the time and usually over considerable periods between shut-downs. It is usually operated approximately 60 days between inspections, but has made runs of 111 and 128 days and at the present time is in it's 99th day of continuous operation.

As will be noted from the accompanying photographs the plant presents a very neat and pleasing appearance. This is especially true of the interior, with cream colored steel deck ceiling, buff glazed brick walls, waxed floors and polished and lacquered copper piping. The fuel tanks, being underground, do not detract from the appearance of the spacious lawn, well kept at all times, and the spray pond with concrete work above ground painted black and cyclone fence painted aluminum is not unsightly.

A very complete and accurate set of records is maintained in considerable more detail than is usual for such a plant, covering both cost and operating data. An annual report is published and sent to all consumers as well as to to anyone else who may be interested on their request.

Conceived as an antidote to the 12 cent rate which existed when the agitation for the plant began, loyally supported by nearly all of the community, operated as efficiently as any private plant, giving the best of service, and bringing the cost of electricity to a point where citizens can afford to use it, the plant has proved to be the most progressive step ever taken by this small but always progressive community.

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air compressors
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A UNIT of COMMERCIAL INVESTMENT TRUST CORPORATION, 1 PARK AVENUE, NEW YORK CITY
CAPITAL AND SURPLUS OVER $100,000,000

Without obligating myself in any way, I am interested in considering taking advantage of your new 5% Modernization Credit Plan to purchase such equipment as:

DESCRIPTION AND MAKE OF EQUIPMENT	ESTIMATED COST

FIRM NAME _____ ADDRESS _____

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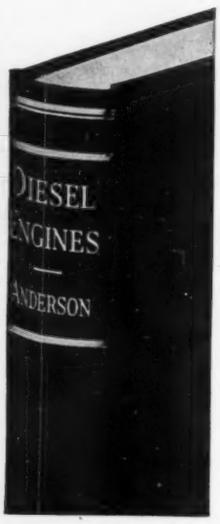
By J. W. ANDERSON

491 *pages, 6 x 9, 284 illustrations,* $5.00



What they are
What they can do
How to select them
How to install them
How to operate them efficiently
How to prevent troubles in operation
What performance may be expected from them
What operation costs should be

This book pictures the Diesel as it is today, shows typical constructions in common use, analyzes the designs, explains the reasons for the designs used, catches the trends of the developments, explains the essentials that go to make up the Diesel installation in its various applications, helps the user to know whether the Diesel is the answer to his power problem, and helps the user and operator to get the performance and satisfaction from the Diesel that are justly due him.

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ATLANTIC HIGHLANDS, N. J.

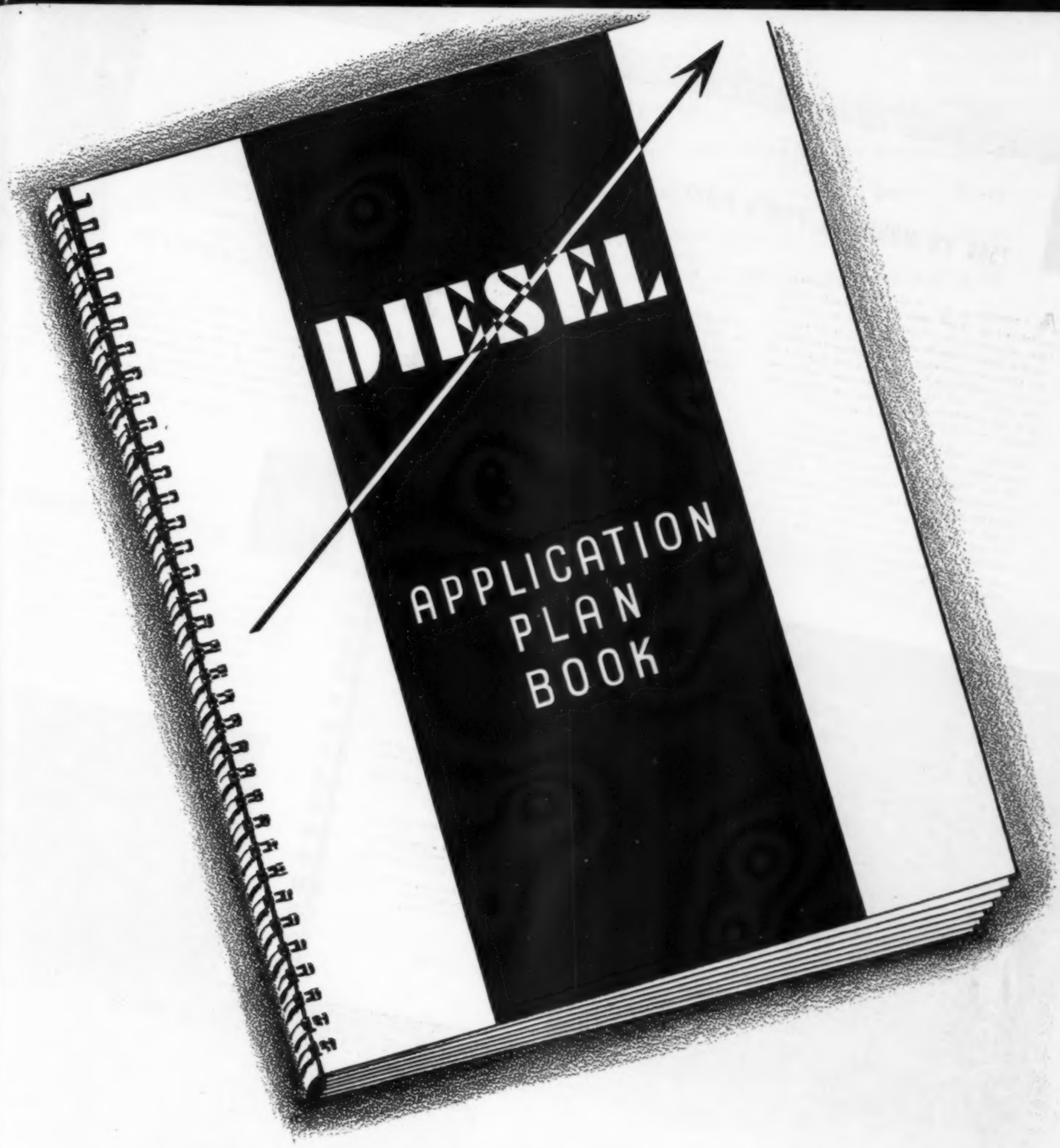
. . . . *Continued from page 43* . . . .

or night, this supply and the capacity of all the Diesel pumps is ample for the Borough's two fire pumpers. As the Diesel engines are fitted with push button starters, just like those on present day automobiles, no valuable starting time is lost, whatever the emergency. And as a safeguard against summer shortages, caused by the increased population and furnishing water to steam boats and steam trains, a secondary standpipe of 19,000 gallons is always in reserve.

Naturally, the Borough engaged a Consulting Engineer to prepare the necessary plans and specifications. Mr. Louis P. Booz of Perth Amboy, N. J., was selected because of his state wide activities in the Municipal Engineering field. As is customary with his layouts, there are many unique features. In this instance, no standby electric motor driven pumps are necessary because of the two primary and two secondary Diesel pumps installed. The flexibility of operation is note-worthy; each Diesel engine is equipped with speed controls. Low cost operation is assured by the automatic governors, which proportions fuel consumption to varying rates of pumpage and pressures.

As an example of economy – the four Fairbanks-Morse Diesel engines were operated for a total of 332 hours from March 15 to April 15, 1936. During that time fuel and lubricating oil costs totaled $91.94 as against $516.00 for electric motor pumping for the same period last year. Further economy is effected by purchasing fuel in tank car lots. As each car is run on to the plant's siding, it is quickly pumped into a 10,000-gallon storage tank by a Rotary Transfer pump. A uniform feed is provided the engines by automatic gravity fuel regulators. Outside of the pump house, one would not know that Diesels are in operation. A suitable Maxim silencer is used on each engine, as the water plant is within a block or two of the residential section and main thoroughfare.

Mayor C. C. Phillips, Water Commissioner Geo. C. Stryker and members of the council take pride in this civic improvement. Besides the water system, the Borough also maintains its own sewage system and incinerator plant. Councilmen and Engineers from near and far have visited this Water Works. They are amazed to find such compactness, ease of operation and flexibility. What really gratifies the Atlantic Highlands taxpayers, is the economy of Diesel pumping.



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132

2500 KW MUNICIPAL POWER PLANT Designs by W. R. Halway

A GROWING municipality of some 10,000 population decided to build its own power plant. Previously, electric lights and power for the city and its residents had been furnished by high line from the utility operating in that vicinity. The project was, therefore, a new one without restrictions as to existing machinery or buildings or size and shape of land plot available. The city naturally took much pride in the plant and resolved to have a modern and efficient plant housed in a building of which they could be proud.

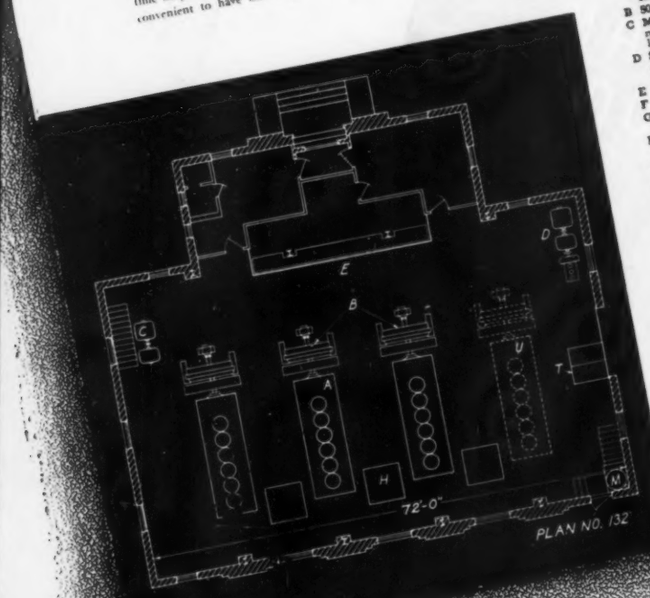
The initial installation was of three 500 kw units. The future fourth unit is to be of twice this individual size, or of 1,000 kw. This gives great flexibility to meet the varying load conditions found in municipal service—a light load during the early morning hours, a moderate load during the daytime, with a heavy peak load during the evening hours. With several units in the station, the number of them in operation can be varied to carry the load and at the same time keep those operating loaded efficiently. And it is very convenient to have one large unit, as there will be when the station is complete, which is much larger in capacity than the others. It can carry a heavy portion of the burden of the peak load.

Furthermore, any engine in the station can be shut down for many hours a day without interfering in any way with having plenty of capacity of equipment available to handle the load. This gives ample time to do all necessary inspection and maintenance work, or to make urgent repairs in case of an accident.

The machinery arrangement adopted for this station is simple and gives excellent light and ventilation, and easy accessibility to every piece of equipment. The location of many of the accessories in the basement clears the main engine room floor of these items and also of the piping which goes with them. The overhead crane reaches everything on the main floor. The exhaust gas waste heat boilers G are reached by lifting the concrete slabs H, and the other items in the basement can be trucked or skidded over under the access door T.

Legend

A Six cylinder 790 hp. 225 rpm. Diesel engine
B 500 kw generator
C Motor generator exciter set—80 hp. motor, 30 kw, 125 volt generator. 1800 rpm.
D Same as C with addition of 50 hp. gasoline engine connected through centrifugal clutch for emergency use
E Switchboard
F Electrical transformers
G Waste heat boiler—runs wet or dry and also acts as muffler
H 5 ft. 6 in. square removable concrete slab in floor for access to boiler
I Lubricating oil centrifugal purifier
J Fuel oil centrifugal purifier
K Fuel oil transfer pumps
L Fuel oil pump
M 200 gallon fuel oil day tank
N 2000 gallon clean fuel oil storage tank
O 300 gpm. centrifugal raw water pump—5 hp. motor
P 400 gpm. centrifugal soft water pump—7½ hp. motor
Q Starting air compressor
R Starting air tanks
S 5 ton hand operated crane and trolley
T 5 ft. 6 in. square access opening in floor covered by steel doors
U Future engine unit of 1500 hp. or 1000 kw
V 750 gallon lubricating oil tank
W Diesel engine foundation
X Air intake filter housing



Legend

A Three cylinder 170 hp. 300 rpm. Diesel engine
B 120 kw direct current generator
C Switchboard
D 6 hp. gasoline engine driven starting air compressor
E 18 in. by 6 ft. starting air tanks
F 5 hp. motor driven starting air compressor
G 200 gallon fuel oil day tank
H Fuel oil filter
I Lubricating oil filter
J Motor driven centrifugal cooling water pump—70 gpm., 100 ft. head. 1850 rpm.

indicates the level of the water in the roof tank on a chart in the engine room, by a low water level alarm, by sight flow indicators and alarms on the water outlet for each engine, and by thermometers on the inlet and outlet of each engine. The hot outlet water from the engines is also circulated in the building hot water system used for showers and washing.

Fuel storage is in a 12,000-gallon tank outside of the build-

ing. The transfer pump de
day tank, thence through fil

Each engine has its own i
pump mounted on the eng
plate pump and delivers
pump delivers a part of
gravity tank on the engi

100 THREE UNIT GENERATOR DRIVE

THIS layout shows a practical and efficient method of combining the power of three engines to drive one generator. It offers great flexibility in engine operation and loading. Each engine unit has its own friction clutch, so that any one or two engines or all three can be operated as desired, or as found necessary to carry the load. Any of the engines can be started or stopped, or the load shifted from one to another without shutting down the generator. It is not necessary to parallel the engine units electrically, since there is only one generator. All the engines are alike with similar character-

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there's little dan
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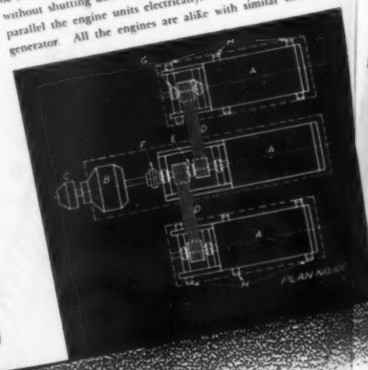
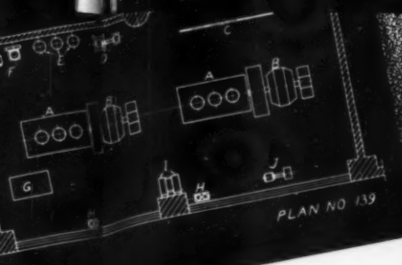


In these three hundred and twenty pages you will find marine, industrial, transportation and aviation applications of the Diesel engine, all in blue print form. It is our hope to provide in this book at least one plan, one application, which will approximate your power requirements, so that you may visualize how easily and efficiently a Diesel application may be worked out to solve your own specific problem.

Something entirely new in technical books. These sample pages are but indicative of the informative, interesting data you will find in this big book. Every facet of the industry covered, every type of application illustrated and described. Actual trim size is 9″ x 12″ with spiral binding.



ing. The transfer pump delivers fuel from this tank to the day tank, thence through filters to the engines.

Each engine has its own independent lubricating system. A pump mounted on the engine takes oil from the engine bed plate sump and delivers it to the pressure system. Another pump delivers a part of the oil to the combination filter and gravity tank on the engine room wall.

RATOR DRIVE

ethod of generator. d loading. at any one sired, or as engines can e to another necessary to e is only one ilar character-

initions and they will divide the load between them. Moreover, there is little danger of overloading an individual engine because the engine power available is generously proportioned relative to the generator capacity. By means of the jaw clutches the V belts can be disconnected entirely from the generator drive shaft. Thus the belts are in motion only when the corresponding engines are supplying power.

The outer engines are mounted on sliding rails embedded in the concrete foundations. This permits of belt tightening.

Legend

A 125 hp. Diesel engine
B 175 kw generator
C Exciter
D V belt drive
E Individual jaw clutches—one for each V belt pulley
F Flexible coupling
G Self aligning pillow block bearings
H Sliding rails—3 per engine

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130

FORGING COMPANY POWER PLANT

A FORGE shop needs electric power and compressed air. The demands are variable. Furthermore, the natural speed of the compressors and generator is quite different from that of the engine. This owner solved all of these problems and placed all of the machinery into the space available in his plant, as shown in the plan.

A heavy duty engine drives the larger of the two compressors and the generator from its own extension shaft. Between the generator and compressor, mounted in its own bearings, driven from the engine shaft by a flexible coupling, for driving the smaller compressor. This avoids any shaft extension. The cutoff coupling is beyond the bearings to the smaller compressor only.

Both the generator and exciter save overhung and give short belt drives. The engine rails so that the belts may be tightened.

The belt drives have idlers for maintaining belt tension.

The air intake connection from the filter on the outside, is very short and direct. The exhaust pipe has a short length of flexible pipe at the engine. Pyrometer equipment is fitted.

Back of the radiator for cooling the jacket water and lubricating oil is a fan, driven through a V belt by a motor mounted on a bracket. The motor is a 1,750 rpm., 15 hp., squirrel cage ball bearing induction type, mounted on an adjustable base for easy belt tightening. The motor starter is of the manually operated reduced voltage type. Note the surge tank for the jacket water placed at the top and alongside of the radiator.

The motor driven circulating water pump takes its suction from the bottom of the radiator, and discharges through the engine jackets back to the top of the radiator, and surge tank which takes care of the changes in volume due to temperature variations. It also helps to insure a full water system under all conditions of operation. The motor has a magnetic across the line starting switch with push button control.

The fuel oil wall tank is equipped with a liquid level gauge and is filled from the storage tank by a hand operated transfer pump. The fuel flows by gravity through a filter to the engine injection pumps.

A complete power plant located across the end of an existing room adjacent to the forge shop room. The outside exposure on three sides gives excellent light and ventilation. Here is the power machinery right alongside of the lathes. This is no disadvantage because the engine foundation is always isolated from the floor and building structure to avoid any possibility of transmission of vibrations.

Legend

A Four cylinder 260 hp. 277 rpm. Diesel engine
B 17 in.-10¼ in. by 12 in. air compressor
C 14 in.-8½ in. by 10 in. air compressor
D 90 kw generator—V belt drive
E Exciter
F Flexible coupling
G Heavy duty double plate cutoff coupling
H Roller bearings, pillow block type
I Switchboard
J Air intake filter
K Exhaust muffler
L Radiator for cooling jacket water and lubricating oil
M Jacket water surge tank
N Jacket circulating water centrifugal pump—1,750 rpm. 60 ft. head
O 100 gallon fuel oil wall tank
P Fuel oil filter
Q Lubricating oil wall tank
R Lubricating oil filter
S 24 in. by 9 ft. standing air receiver
T 4 in. by 2½ in. by 8½ in. intermittent duty air cooled two stage starting air compressor
U Lathe

|24|

DIESELIZATION will be the progress of aviation. All have profited from the outstandi engine, and it is only logical that in the air. Great strides have been in other countries. Low fuel consu and elimination of fire hazard shou for its adoption by the aircraft industr

Several kinds of aircraft are included in ing installations of Diesel engines of diff present time, in this particular field, the two-cycle engine on account of its greater smoother running. Liquid cooling, using

Legend

A Engine—twelve vertically-opposed cylinders, supercharged, water-cooled, geared, 600 hp. at 2,200 rpm. rated, 700 hp. at 2,350 rpm. at 9,000 ft.
B Propeller shaft
C Controllable pitch propeller, hydraulically operated, 3-bladed metal
D Radiator with controllable shutters
E Engine nacelle
F Tanks for Diesel fuel, total capacity 170 gals.
G Tanks for lubricating oil, total capacity 26 gals.
H Engine and plane controls
I Wings, total area 888 sq. ft.
J Tail assembly with two rudders and fins
K Passengers' cabin, sound proofed, 350 cu. ft. capacity
L Passengers' seats, adjustable
M Pilot's cabin, for pilot and radio operator
N Toilet
O Entrance to cabins
P Radio equipment, sending and receiving
Q Retractable landing gear, electrically operated
R Mail and express compartment, 62 cu. ft. capacity
S Baggage compartment, 81 cu. ft. capacity

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DIESEL APPLICATION PLAN BOOK

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Check Lists

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- Industrial
- Marine

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Address _____

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LONDON LETTER No. 10

. . . . *Continued from page 38* . . . .

speed Diesel to be built in Europe for marine propulsion. Constructed on sound and well-proven lines, this machine is a development of the firm's range of smaller in-line and V-12 engines. It is designed for an output of 320 bhp. at 900 rpm. and has a 6 in. bore and 7 in. stroke. The crankcase is a massive cast iron casting with large inspection doors through which the main and big end bearings and articulation bearings may be inspected. Where a reduction in weight is required aluminum alloy may be substituted for the cast iron for such parts as sump, casings, inspection doors, etc.

Each bank of cylinders has its own duplex, chain-driven, built-up camshaft, the horizontally opposed valves being operated through the medium of pivoted rocking levers. The exhaust valves are operated direct and the inlets by pull rods. The inlet valves are carried in removable cages, thus affording immediate access to the valve gear merely by the removal of the cambox covers and inlet manifold. It is not necessary to touch the exhaust manifold, cylinder heads or water pipes.

For starting, a radial air motor of Gleniffer design is used. This is mounted on the forward end of the engine timing case and drives a pinion geared to the flywheel through a long tubular shaft. Starting is carried out very simply by means of one lever.

The first pair of 16-cylinder engines has been ordered by the Royal Canadian Mounted Police for one of their patrol boats, and two more are now under construction for a second installation. Canada's "bad men" will have to look out for themselves when these Diesel boats get on their trail!

DIESEL LIVESTOCK TRUCK

. . . . *Continued from page 25* . . . .

point of delivery. The unit is also being used for transferring sheep between grazing fields.

This particular Diesel design meets a special need of the sheep raising industry in that it provides both the speed of delivery required, to prevent loss of weight, and it also insures the delivery of the sheep in good condition by cutting down the long lay-overs in the hot San Joaquin Valley, which formerly caused some loss to the shippers through their arrival in poor condition, and bringing lower prices.

DIESEL PROGRESS

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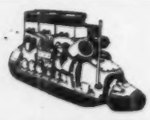
Superior DIESELS

15 KW Superior Diesel Electric unit installation in Slackwood Diner on Route 25, Trenton, New Jersey, owned by Mr. Vincent Budny.

MR. BUDNY selected the Superior Diesel Engine for his installation because of its rugged construction and the dependable service that had been demonstrated in many similar applications . . . This 15 KW plant operates 24 hours a day, seven days a week with but twenty minutes shut-down once each week to change oil . . . In addition to lighting and power service, Mr. Budny does all his cooking by electricity and heats the diner in the winter by recovering the heat from the cooling system . . . The saving in power cost, uninterupted service and increase in night business due to better lighting display has confirmed Mr. Budny's judgement in the selection of a Superior Diesel . . . Sizes from 10 to 60 KW—alternating or direct current.

Write for Bulletin DPS-535



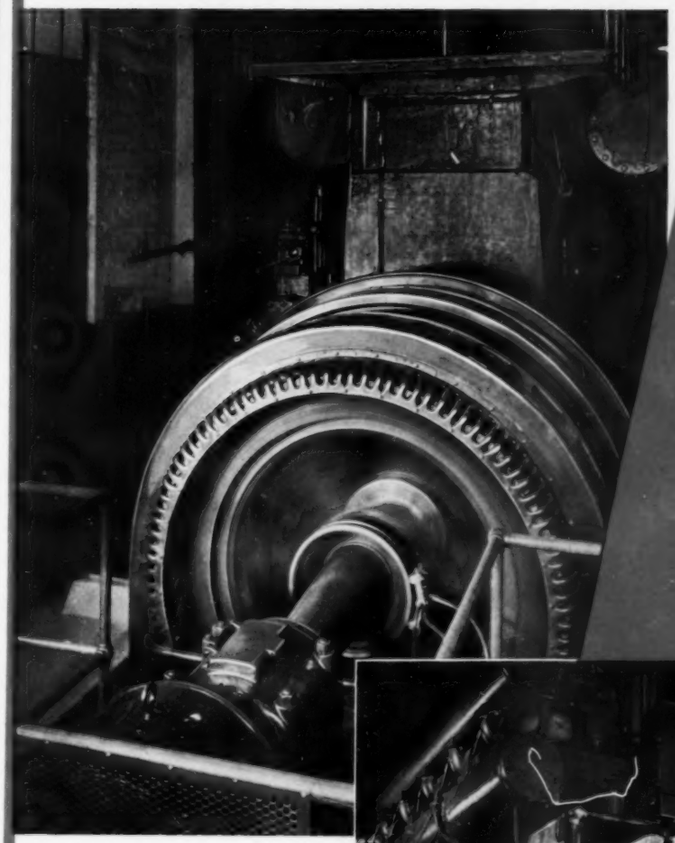
25 to 150 H. P.

THE NATIONAL - SUPERIOR COMPANY
SPRINGFIELD, O. . . . LOS ANGELES, CAL.

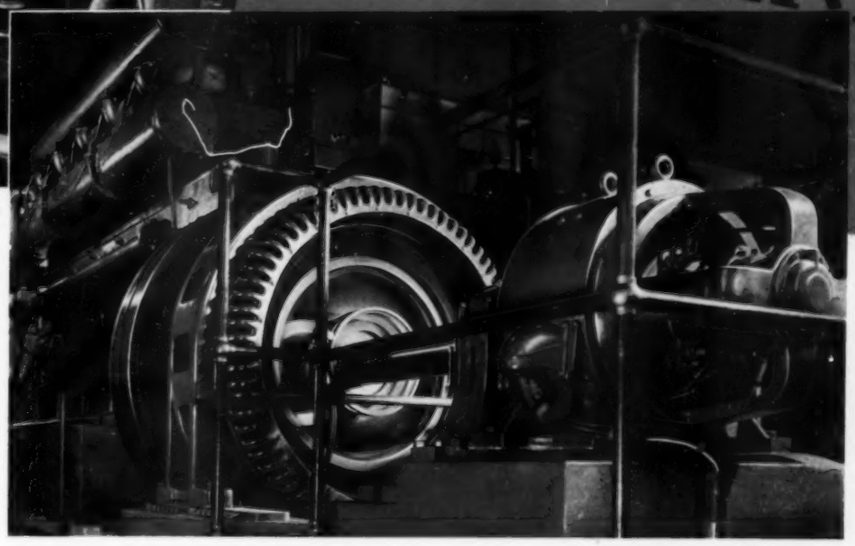
50 to 900 H. P.

THE OTTO ENGINE WORKS . . . . PHILADELPHIA, PA.

FORD CITY PA. chooses its second ELLIOTT GENERATOR



The Elliott 500-kw. generator and exciter serving the Nordberg Diesel engine installed in the Ford City plant in 1932.



The Elliott 300-kw. generator and exciter serving the Worthington Diesel engine installed this year in the Ford City Municipal Plant.

IN 1931 the Municipal Power Plant at Ford City, Pa., began changing its electric generating equipment from gas engines to Diesels. In 1932 a Nordberg 3-cylinder, 2-cycle, 277-rpm. air injection engine direct connected to an Elliott 500-kw., 80% p.f., 2400-volt generator with direct-coupled 125-volt exciter was installed. This unit has been kept in practically continuous operation, with the gas engine units being used for emergencies and during peak load periods.

This year the second Diesel engine unit was installed, a 450-hp., 6-cylinder, 4-cycle, 327-rpm. Worthington engine direct connected to an Elliott 300-kw., 80% p.f., 2400-volt generator with direct-coupled 10-kw., 125-volt exciter.

The Elliott generators at Ford City are required to operate in parallel with each other and with the gas-engine generators. This they have done very satisfactorily. The operating record of the first generator has been perfect and the owners, therefore, requested that the second generator be an Elliott.

A complete description of the Ford City Municipal Plant by Mr. Joseph Breslove, Consulting Engineer of Pittsburgh and Cleveland, appeared in the Summer, 1936, issue of our quarterly publication *Powerfax*. We will be glad to send copies to interested people.

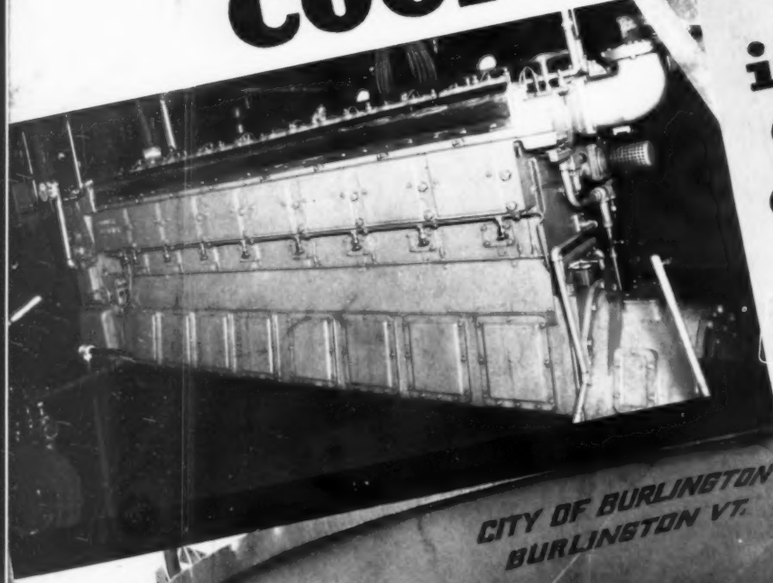
ELLIOTT COMPANY
PITTSBURGH, PENNSYLVANIA

Electric Power Dept., RIDGWAY, PA.
District Offices in Principal Cities

J-65

COOPER • BESSEMER DIESELS

in the newest *Streamlined* FERRIES



It was a "great day" up in Vermont when they christened the sleek new "City of Burlington." She's one of two streamlined ferries of modern type that will be operated by the Green Mountain - Adirondack Ferry Company, on Lake Champlain.

In the design and construction of these latest "streamliners," the owners have "gone the limit" in eliminating friction, getting the best speed, and insuring the utmost **convenience**, **reliability** and **economy** of operation.

In line with these plans, Cooper-Bessemer Diesel power was chosen. The "City of Burlington" and her sister craft (now under construction) each have a Type JT-8 direct-reversing engine, rated 450 H.P. at 360 r.p.m.

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